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The land snail family Clausiliidae (Gastropoda, Pulmonata, Stylommatophora) in Georgia: overview, novel records and a new species

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Abstract

The Caucasus ecoregion is one of the most important biodiversity hotspots in western Eurasia. Georgia is situated in the middle of this area, between the ranges of the Greater and Lesser Caucasus, a position providing exceptionally balanced environmental conditions for its flora and fauna. Animal groups of low mobility, such as land snails, are important indicators of the past and present geographic and climatic events shaping these unique ecosystems. We give an overview of the land snail family Clausiliidae in Georgia that includes 30 species, among which eight are endemic to this country. Their distribution areas are reassessed in the light of novel georeferenced occurrence data resulting from recent field work. Aspects of the origin, diversity, habitat requirements and conservation status of the Georgian Clausiliidae fauna are discussed. Additionally, *Mucronaria* (*Mucronaria*) *kartvelica* sp. n. is described from the Racha-Lechkhumi and Kvemo Svaneti Region.

Key words

Caucasus, endemisms, land snails, new species, zoogeography

Introduction

The Caucasus ecoregion is a major biodiversity hotspot in western Eurasia (Myers et al. 2000; Zazanashvili et al. 2005). The origin of its rich flora and fauna with a multitude of endemic and relict species can be traced back to the forest refuges of the Colchic and Hyrcanian regions, which preserved their mild and humid climate throughout the entire Pleistocene period (Kikvidze and Oshawa 2001; Wielstra et al. 2013; Tarkhnishvili 2014). The geological and climatic fragmentation of formerly continuous distribution areas also contributed to the species richness of the Caucasus Isthmus. This is well exemplified by the remarkable diversity of land snails, an animal group with low mobility (Walther et al. 2016, 2018; Hausdorf et al. 2018; Neiber et al. 2018, 2022).

The family of the Clausiliidae is one of the most species-rich and best studied groups of land snails in the Caucasus region. Remarkably, 89 of the 92 clausiliid species occurring here are endemic to this ecoregion. A particularly high diversity can be seen in Georgia, which is home to more than 30% of the region's clausiliid species.

In Georgia the second half of the 19th century brought a golden age of natural history research. Extensive field trips of the devoted naturalist explorers Frédéric Dubois de Montpéreux, Gustav Radde, Hans Leder, Alexander Schläfli, Carl Reuleaux and Alexander Brandt made available a trove of unknown species, which were then forwarded to specialists for identification. The resulting pioneering publications of Ludwig Pfeiffer (1846), Albert Mousson (1856, 1863, 1876a, 1876b), Oskar Boettger (1877, 1878a, 1878b, 1878c, 1879a, 1879b, 1880a, 1880b, 1881a, 1881b, 1883,

1886, 1887, 1888) and Otto Retowski (1889, 1899) provided the descriptions, and also some distribution records, of most of the Georgian clausiliids. By contrast, the tumultuous first half of the 20th century proved unfavourable for mollusc studies, yielding only few clausiliid-related papers (Rosen 1914; Kokochashvili 1940, 1941; Javelidze 1941). Thereafter a renewed interest in the region's land snails resulted in several further contributions (Likharev and Rammelmeier 1952; Likharev and Lezhava 1961; Likharev 1962; Lezhava 1962, 1964, 2004; Nordsieck 1975, 1976; Natsvlishvili 1967; Sysoev and Schileyko 2009; Pokryszko et al. 2011; Fehér et al 2014; Mumladze et al. 2017; Hausdorf et al. 2018; Mumlaze and Szekeres 2020; Neiber et al. 2021) that considerably increased our knowledge of the Georgian Clausiliidae fauna. As a result, the taxonomic positions and distribution areas of the species, as well as the fauna composition became quite well assessed. However, there are still relatively few well defined occurrence records of the clausiliid taxa, data that could help better identifying and protecting their preferred habitats.

This paper offers an overview of the clausiliids of Georgia without the territories of Abkhazia and South Ossetia (i.e., parts of the Racha-Lechkhumi, Shida Kartli and Mtskheta-Mtianeti Regions). New georeferenced locality data, stemming mainly from the authors' field trips during the past two decades, as well as considerations on the historic and zoogeographic aspects of the distribution areas, give an updated assessment of this unique fauna. Additionally, we provide a taxonomic description of a recently discovered species of the genus *Mucronaria* Boettger, 1877.

Materials and methods

The occurrence data listed in the Results are based on georeferenced samples that were collected during the past two decades. For comparison, the maps showing the occurrence points also include well defined locality data that have been provided in the publications of Majoros and Németh (1997), Pokryszko et al. (2011), Fehér et al. (2014), Mumladze et al. (2017) and Neiber et al. (2021).

The new occurrence data are given by the administrative regions of Georgia and in a north to south order. The geographic coordinates and altitude are followed by the abbreviated name(s) of the collector(s), the collection year and, in brackets, the abbreviations identifying the collection(s) where the voucher material is housed. In the maps black dots denote the occurrence points reported in this paper, whereas white dots correspond to those that are derived from the aforementioned five publications. Estimation of extent of occupancy (EOO) was based on the minimum convex polygon delimiting the entire distribution range of a species. Area of occupancy (AOO) was calculated as the sum of 2 x 2 km grid cells containing georeferenced occurrence of a species in Georgia. For areas exceeding 10,000 km^2 the infinity symbol is used. EOO and AOO data are given only for species that are endemic to Georgia or near-endemics with distribution ranges extending only slightly beyond the borders of the country.

The listed samples were collected by Ani Bikashvili (AB), Elizaveta Chertoprud (EC), Olga Danilova (OD), Jozef Grego (JG), Bella Japoshvili (BJ), Levan Mumladze (LM), Tornike Mumladze (TM), Dávid Murányi (DM), Mari Murtskhvaladze (MM), Mate Natsvlishvili (MN), Mário Olšavský (MO), Igor Solodovnikov (IS) and Miklós Szekeres (MS). The collections mentioned in the text are those of the Field Museum of Natural History, Chicago (FMNH), Florida Museum of Natural History, Gainesville (UF), Hungarian Natural History Museum, Budapest (HNHM), Ilia State University, Tbilisi (ISU), Muséum National d'Histoire Naturelle, Paris (MNHN), Naturhistorisches Museum Wien (NHMW), Naturmuseum und Forschungsinstitut Senckenberg, Frankfurt am Main (SMF), Zoological Museum Moscow State University (ZMMU), Zoological Museum Hamburg (ZMH), as well as of Jozef Grego, Banská Bystrica (JG) and Miklós Szekeres, Budapest (MS).

Results

Family Clausiliidae Gray, 1855

Subfamily Phaedusinae Wagner, 1922

Caspiophaedusa perlucens (Boettger, 1877)

Figures 1A, 2A

Clausilia perlucens — Boettger 1877: p. 73

Type locality. "Kaukasus".

Distribution. Southeastern areas of the Greater and Lesser Caucasus, as well as the Talysh and Alborz Mountains in Iran.

Habitat. Moist forests; in the texture and under the bark of decaying trees.

Occurrence data. Kakheti • N41.9837°, E45.8456°; 680 m; leg. LM, 2010 (ISU) • N41.9823°, E45.8540°; 840 m; leg. JG-LM-MS, 2021 (MS) • N41.9823°, E45.8540°; 840 m; leg. LM, 2010 (ISU) • N41.9761°, E45.8413°; 630 m; leg. JG-LM-MS, 2021 (MS) • N41.8490°, E46.3314°; 1300 m; leg. LM, 2010 (ISU) • N41.4935°, E46.1009°; 680 m; leg. LM, 2010 (ISU) • N41.4921°, E46.0994°; 710 m; leg. JG-LM-MS, 2021 (ISU, JG, MS).

Dobatia goettingi (Brandt, 1961)

Figure 1B

Serrulina (*Serrulina*) *goettingi* — Brandt 1961: p. 18, plate 2 fig. 17

Type locality. Turkey, Bolu Province, vicinity of Lake Abant.

Distribution. Southeastern Bulgaria and northwestern Turkey to Samsun toward east.

Habitat. Humid broadleaf forests; in the trunks and roots of decaying trees.

Remark. This species does not occur in Georgia. An empty shell (ZMMU Lc-29847), collected from sea flotsam at the Black Sea coast of Adjara, was presented erroneously as *Serrulinella senghanensis* (Germain, 1933) (Egorov 2001; Sysoev and Schileyko 2009). It belongs to *Dobatia goettingi*, which has also been recorded from coastal flotsam of the Crimean Peninsula (Retowski 1887; Reischütz et al. 2016).

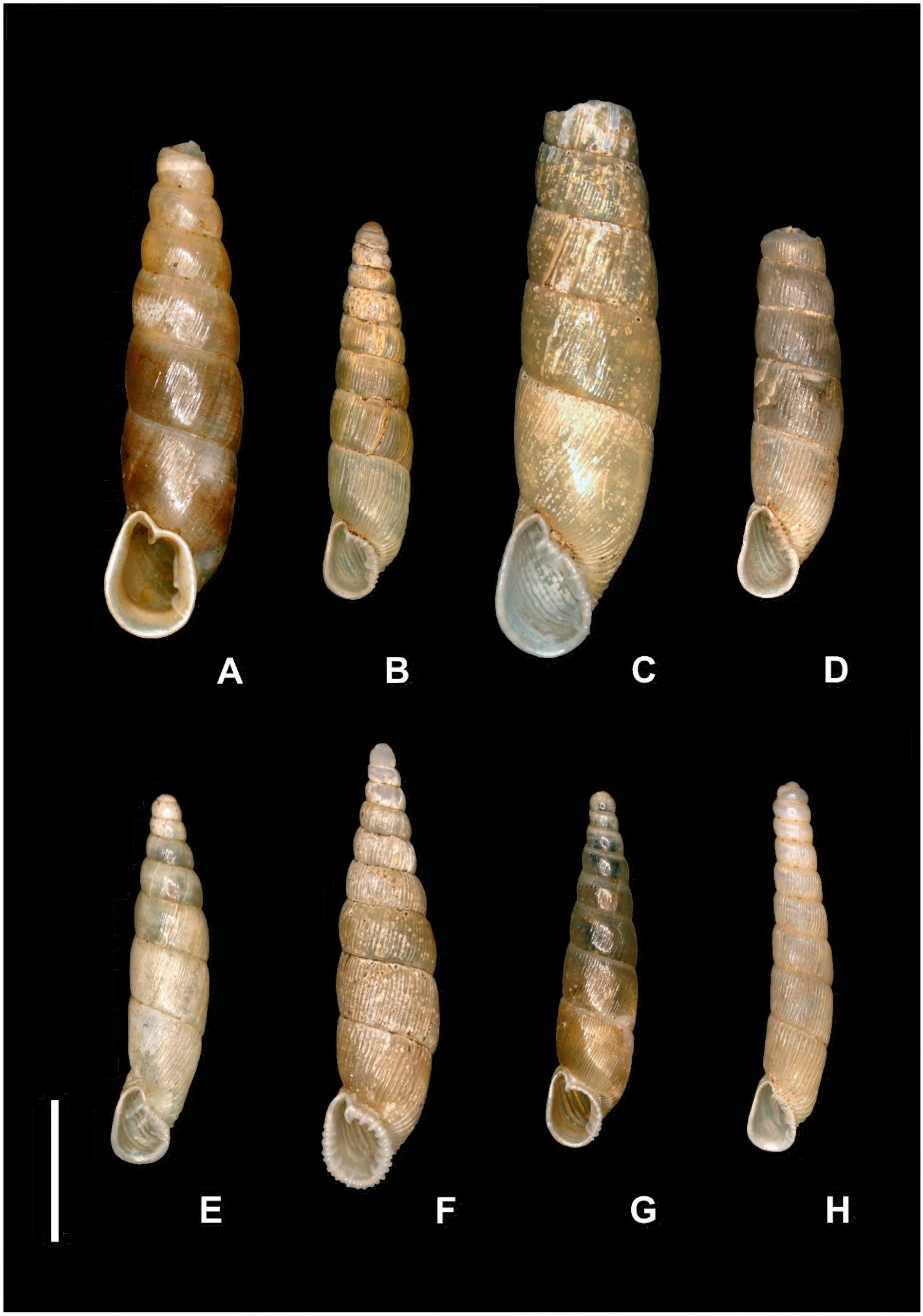

Figure 1. (**A**) *Caspiophaedusa perlucens*, Kakheti, Artsivi Gorge northwest of Dedoplistskaro, N41.4921°, E46.0994°. (**B**) *Dobatia goettingi*, Turkey, 9 km northeast of Lake Abant, N40.6569°, E31.3892°. (**C**) *Pontophaedusa funiculum*, Adjara, Makhinjauri northeast of Batumi N41.6713°, E41.6900°. (**D**) *Pontophaedusa gregoi*, Imereti, between Chiatura and Katskhi, N42.2836°, E43.2113°. (**E**) *Pravispira semilamellata*, Samegrelo-Zemo Svaneti, northwest of Khobi, N42.3944°, E41.8382°. (**F**) *Serrulina serrulata*, Kakheti, valley of the Alazani River near Birkiani, N42.2368°, E45.3386°. (**G**) *Serrulina sieversi*, Iran, Gilan Province, valley of the Shim Rud south of Siyahkhal, N37.0239°, E49.8769°. (**H**) *Serrulinella senghanensis*, Iran, Gilan Province, valley of the Shim Rud at Lunak, N37.0089°, E49.8642°. Scale bar: 5 mm.

Pontophaedusa funiculum (Mousson, 1856)

Figures 1C, 2B

Clausilia funiculum — Mousson 1856: p. 396

Type locality. Boztepe (Turkey, suburb of Trabzon).

Distribution. Southeastern and eastern coastal areas of the Black Sea between Trabzon (Turkey) and Tuapse (Russia).

Habitat. Colchic broadleaf forests; in the texture and under the bark of decaying trees.

Occurrence data. Adjara • N41.7074°, E41.7759°; 40 m; leg. LM, 2016 (ISU) • N41.7020°, E41.7211°; 70 m; leg. JG, 2017 (JG) • N41.6713°, E41.6900°; 30 m; leg. JG, 2017 (JG, MS) • N41.5652°, E41.5871°; 310 m; leg. LM-TM, 2019 (ISU).

Pontophaedusa gregoi Mumladze & Szekeres, 2020

Figures 1D, 2C

Pontophaedusa gregoi — Mumladze and Szekeres 2020: p. 151, figs 1, 2

Type locality. Katskhi (Imereti Region).

Distribution. Near Katskhi and Zastafoni in central Imereti Region.

Habitat. Karstic broadleaf forests; primarily in subterranean rock crevices.

Occurrence data. Imereti • N42.2836°, E43.2113°; 500 m; leg. JG-LM-MS, 2021 (ISU, NHMUK 20220497, NHMW-MO-113738, JG, MS).

Pravispira semilamellata (Mousson, 1863)

Figures 1E, 3A

Clausilia semilamellata — Mousson 1863: p. 396

Type locality. "Réduktaleh" (misspelled Redutkaleh, = Kulevi, Samegrelo-Zemo Svaneti Region).

Distribution. Mountains along the Black Sea coast between Rize (Turkey) and Tuapse (Russia), the Lesser Caucasus and the southern slopes of the Greater Caucasus west of Tbilisi. Isolated occurrences near Vladikavkaz (Russia), Gebele (Azerbaijan), and in the Talysh Mountains (Iran).

Habitat. Forests up to around 2000 m; in the texture and under the bark of decaying trees.

Occurrence data. Adjara • N41.7959°, E41.9452°; 210 m; leg. LM, 2018 (ISU) • N41.7377°, E41.9839°; 440 m; leg. LM, 2010 (ISU) • N41.6458°, E42.4853°; 1630 m; leg. LM, 2017 (ISU). **Imereti** • N42.5028°, E42.5579°; 860 m; leg. JG, 2017 (JG) • N42.5023°, E42.5595°; 880 m; leg. JG-LM, 2018 (JG) • N42.2443°, E43.2780°; 410 m; leg. AB-BJ-LM, 2021 (ISU) • N42.1612°, E43.3577°; 830 m; leg. AB-BJ-LM, 2021 (ISU) • N42.1499°, E43.3025°; 540 m; leg. AB-BJ-LM, 2021 (ISU) • N42.1476°, E42.8037°; 130 m; leg. LM, 2012 (ISU). **Kakheti** • N42.2368°, E45.3386°; 900 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.8759, E45.3564; 1080 m; leg. LM, 2010 (ISU) • N41.8647°, 45.3355°; 1260 m; leg. LM, 2010 (ISU). **Kvemo Kartli** • N41.7511°, E44.5094°; 1610 m; leg. LM, 2021 (ISU). **Mtskheta-Mtianeti** • N41.8484°, E44.6379°; 480 m; leg. LM, 2014 (ISU). **Racha-Lechkhumi and Kvemo Svaneti** • N42.5681°, E43.4953°; 1060 m; leg. LM, 2014 (ISU) • N42.5561°, E43.5691°; 1560 m; leg. EC-JG-LM-MO-MS, 2022 (ISU) • N42.5466°, E43.5308°; 1070 m; leg. EC-JG-LM-MO-MS, 2022 (MS) • N42.4030°, E42.9697°; 1500 m; leg. JG, 2021 (JG) • N42.3914°, E42.9823°; 1520 m; leg. JG-MS, 2021 (JG, MS). **Samegrelo-Zemo Svaneti** • N43.0652°, E42.4113°; 1250 m; leg. LM, 2010 (ISU) • N42.9109°, E42.0765°; 740 m; leg. LM, 2010 (ISU) • N42.7528°, E42.5093°; 2050 m; leg. LM, 2014 (ISU) • N42.7367°, E42.5015°; 1600 m; leg. LM, 2015 (ISU) • N42.4774°, E42.4587°; 700 m; leg. JG, 2019 (JG, MS) • N42.3944°, E41.8382°; 450 m; leg. JG-MS, 2021 (JG, MS). **Samtskhe-Javakheti** • N41.8092°, E43.3112°; 970 m; leg. LM, 2012 (ISU) • N41.7912°, E43.4665°; 1240 m; leg. LM, 2012 (ISU).

Serrulina serrulata (Pfeiffer, 1847)

Figures 1F, 3B

Clausilia serrulata — Pfeiffer 1847: p. 71

Type locality. "Tauria" (= Crimea; erroneous!).

Distribution. Northern Anatolia, as well as the Greater and Lesser Caucasus ranges to Zaqatala (Azerbaijan) toward east. Isolated occurrences in the Northern Caucasus near Vladikavkaz, the Ukrainian Carpathians, eastern regions of Romania and Bulgaria, as well as in Hatay Province in southern Turkey.

Habitat. Humid, primarily broadleaf forests up to around 2000 m; in the texture and under the bark of decaying trees.

Occurrence data. Adjara • N41.7477°, E42.0996°; 1860 m; leg. LM, 2018 (ISU) • N41.7351°, E42.0930°; 1180 m; leg. LM, 2010 (ISU) • N41.6527°, E41.7625°; 550 m; leg. LM, 2017 (ISU). **Imereti** • N42.3829°, E43.0122°; 950 m; leg. JG-LM, 2018 (JG, MS). **Kakheti** • N42.2368°, E45.3386°; 900 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.0539°, E45.5274°; 480 m; leg. LM, 2019 (ISU) • N41.9823°, E45.8540°; 840 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.9823°, E45.8540°; 840 m; leg. LM, 2010 (ISU) • N41.8759°, E45.3564°; 1080 m; leg. LM, 2010 (ISU) • N41.8556°, E46.3410°; 1730 m; leg. LM, 2010 (ISU). **Mtskheta-Mtianeti** • N42.0974°, E44.8236°; 1420 m; leg. LM, 2010 (ISU). **Racha-Lechkhumi and Kvemo Svaneti** • N42.3914°, E42.9823°; 1520 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.3876°, E42.9748°; 1500 m; leg. LM, 2018 (ISU). **Samegrelo-Zemo Svaneti** • N42.9109°, E42.0765°; 740 m; leg. LM, 2010 (ISU) • N42.6599°, E42.4330°; 950 m; leg. LM, 2010 (ISU) • N42.3944°, E41.8382°; 450 m; leg. LM, 2010 (ISU), JG-MS, 2021 (JG, MS).

Serrulina sieversi (Pfeiffer, 1871)

Figure 1G

Clausilia sieversi — Pfeiffer 1871: p. 70

Type locality. Lankaran (Azerbaijan).

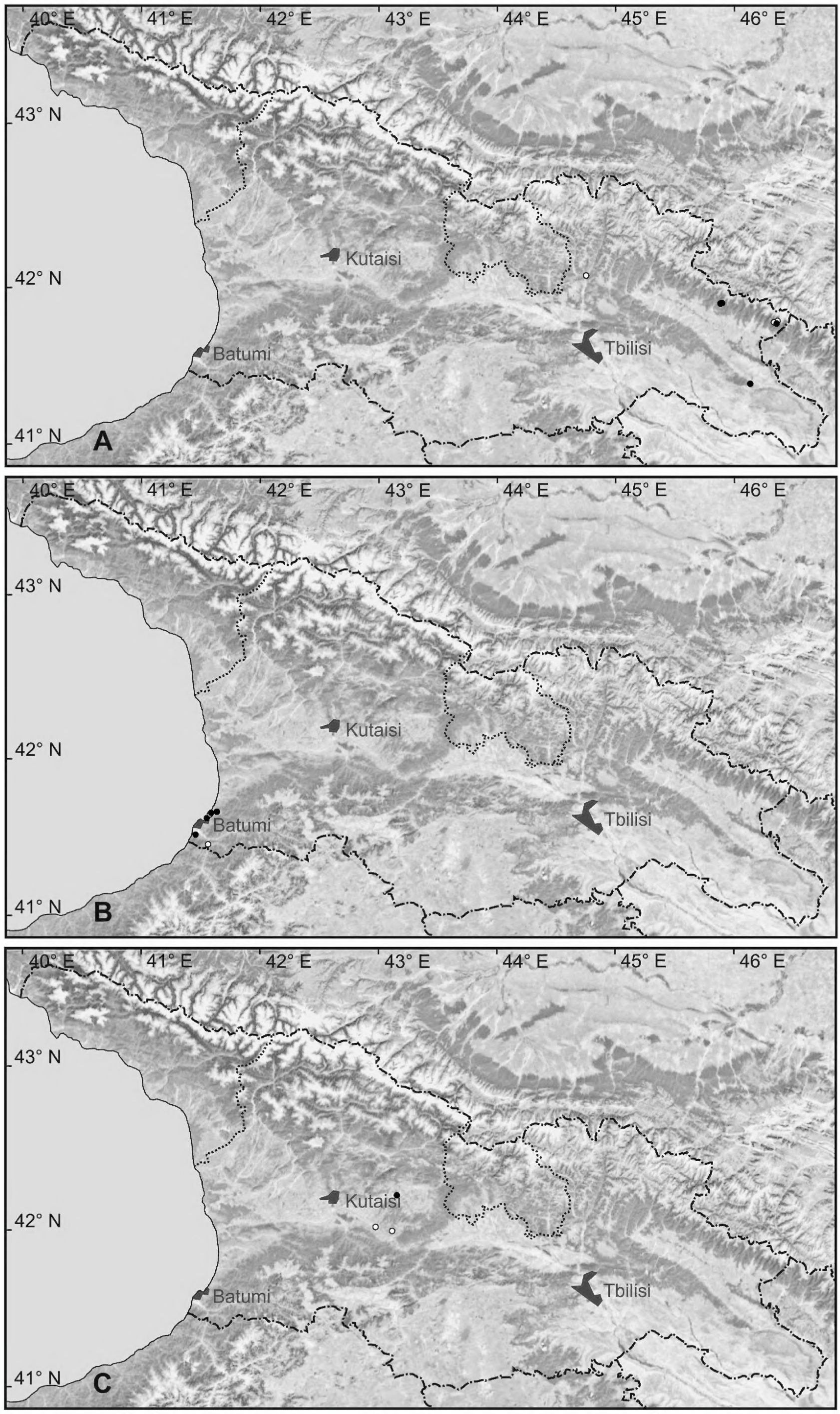

Figure 2. Occurrence records of *Caspiophaedusa perlucens* (A), *Pontophaedusa funiculum* (B) and *Pontophaedusa gregoi* (C). Black and white dots corrsepond to novel and published data, respectively.

Distribution. The Talysh Mountains in Azerbaijan and Iran, as well as the Alborz Mountains in Iran to eastern Mazandaran Province. Isolated along the southern slopes of the Greater Caucasus around Zaqatala (Azerbaijan).

Habitat. Moist broadleaf forests up to 1500 m; in the texture and under the bark of decaying trees.

Remark. According to its description, the subspecies *S. sieversi occidentalis* Likharev, 1962 occurs between Lagodekhi (Kakheti Region) and Zaqatala in Azerbaijan. Though in the Zoological Museum of Moscow State University there is a sample of this form with locality given as the Lagodekhi Nature Reserve (ZMMU Lc-246280, leg. N. Bekman, 1961), it was not found during several recent field trips to this region. Thus the presence of *S. sieversi* in Georgia needs to be confirmed.

Serrulinella senghanensis (Germain, 1933)

Figure 1H

Serrulina senghanensis — Germain 1933: p. 391

Type locality. "Siah Senghan" (locality in Iran's Gilan Province).

Distribution. This species is known only from a small area in the Alborz Mountains south of Lahijan (Iran, Gilan Province).

Habitat. Moist broadleaf forests in karst areas; in subterranean rock crevices.

Remark. Reports of this Iranian species from Georgia (Egorov 2001; Sysoev and Schileyko 2009) were based on a marine flotsam specimen of *Dobatia goettingi*. See remark at that species.

Subfamily Clausiliinae Gray, 1855

Acrotoma (*Iliamneme*) *baryshnikovi* Likharev & Schileyko, 2007

Figures 3C, 4A

Acrotoma (*Iliamneme*) *baryshnikovi* — Likharev and Schileyko 2007: p. 65, figs 1, 2

Type locality. Akhsargina (South Ossetia).

Distribution. Mountain ridge between Kvedi (Racha-Lechkhumi and Kvemo Svaneti Region) and Kvaisi (South Ossetia).

Habitat. Karst areas; on and underneath limestone cliffs.

Occurrence data. Racha-Lechkhumi and Kvemo Svaneti • N42.5561°, E43.5721°; 1510 m; leg. JG-MS, 2021 (JG, MS) • N42.5561°, E43.5691°; 1560 m; leg. JG-MS, 2021 (ISU, NHMUK 20220498, NHMW-MO-113739, JG, MS); EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.5467°, E43.5309°; 1080 m; leg. LM, 2022 (ISU); JG-LM-MS, 2022 (ISU, JG, MS).

Acrotoma (*Iliamneme*) *enguriensis* Hausdorf, Walther & Neiber, 2018

Figures 4B, 5A

Acrotoma (*Iliamneme*?) *enguriensis* — Haudsorf et al. 2018: p. 698, figs 4, 28, 44, 45, 52

Type locality. Mountain ridge between the Enguri and Magana Rivers, north of Jvari (Samegrelo-Zemo Svaneti Region).

Distribution. Known only from the type locality.

Habitat. Karst areas; on and underneath limestone cliffs.

Occurrence data. Samegrelo-Zemo Svaneti • N42.7500°, E42.0489°; 470 m; leg. JG-LM, 2018 (ISU, NHMUK 20220499, NHMW-MO-113740 JG, MS) • N42.7410°, E42.0483°; 420 m; leg. JG-MS, 2021 (JG, MS).

Armenica (*Armenica*) *unicristata* (Boettger, 1877)

Figures 4C, 5B

Clausilia unicristata — Boettger 1877: p. 75

Type locality. "Ekatherinenfeld" (= Bolnisi, Kvemo Kartli Region).

Distribution. Occurs sporadically in southern and southeastern Georgia, northern and southeastern Armenia, as well as northern and western Azerbaijan.

Habitat. Exposed metamorphic or limestone cliffs; around and inside rock crevices.

Occurrence data. Kakheti • N41.4896°, E46.0976°; 750 m; leg. DM, 2019 (HNHM 104483) • N41.4888°, E46.0956°; 760 m; leg. JG-LM-MS, 2021 (ISU, JG, MS). **Samtskhe-Javakheti** • N41.7014°, E43.5131°; 2210 m; leg. JG-LM-MS, 2021 (ISU, JG, MS).

Remarks. The *Armenica* from Sakavre (Shida Kartli Region) (ISU B27-501), mentioned by Lezhava (1964) as *A. gracillima* (Retowski, 1889), belongs to this species. Another sample from Akhalsopeli (Kvemo Kartli Region), mentioned in the same paper as *Armenica brunnea* (Rossmässler, 1939), could not be located but is assumed to be also *A.* (*A.*) *unicristata*. In Lezhava's collection we found a further sample of this species from Gujareti (Samtskhe-Javakheti Region) (ISU 485), a yet unpublished locality.

Armenica (*Astrogena*) *griseofusca* (Mousson, 1876)

Figure 4D

Clausilia (*Alinda*) *griseofusca* — Mousson 1876b: p. 145, plate 5 fig. 3

Type locality. Vicinity of Lake Tabatskuri (Samtskhe-Javakheti Region; possibly erroneous!).

Distribution. All verified localities of this species are in Trabzon and Rize Provinces of Turkey.

Habitat. Broadleaf or mixed forests between 1000 and 1500 m; on tree trunks and small, shaded cliffs.

Remark. The description and a probable syntype (SMF 144161) identify *Armenica* (*Astrogena*) *griseofusca* as the species currently known from northeastern Turkey. However, the type locality around Lake Tabatskuri is far from the distribution area in Turkey and lacks similar habitats. Therefore, and because this species has not been found there ever since, the locality given by Mousson seems to be erroneous.

Elia (*Caucasica*) *ossetica* (Mousson, 1863)

Figures 4E, 5C

Clausilia somchetica var. *ossetica* — Mousson 1863: p. 399

Type locality. "Koischet" (unidentified site, likely on the northern slopes of the Greater Caucasus near the border between Chechnya and Dagestan, in Russia).

Distribution. Central regions of the Greater Caucasus, as well as the Lesser Caucasus between Borjomi (Samtskhe-Javakheti Region) and Lake Sevan (Armenia).

Habitat. Moist mountain forests and rocky subalpine meadows up to 2500 m; among leaf litter, in rock crevices and under stones.

Occurrence data. Mtskheta-Mtianeti • N42.6979°, E44.6188°; 1910 m; leg. LM, 2017 (ISU) • N42.5377°, E44.4927°; 2280 m; leg. LM, 2017 (ISU) • N42.4858°, E44.4788°; 2440 m; leg. OD-IS, 2009 (IS, MS) • N42.4148°, 44.5500°; 1690 m; leg. LM, 2010 (ISU) • N42.3105°, E45.1229°; 1490 m; leg. LM, 2010 (ISU). **Kakheti** • N42.2368°, E45.3386°; 900 m; leg. JG-LM-MS, 2021 (ISU, MS) • N42.2229°, E45.3020°; 810 m; leg. DM, 2019 (HNHM 104475) • N41.8759°, E45.3564°; 1080 m; leg. LM, 2010 (ISU). **Shida Kartli** • N41.8359°, E44.2441°; 1100 m; leg. LM, 2009 (ISU).

Elia (*Caucasica*) *somchetica* (Pfeiffer, 1846)

Figures 4F, 6A

Clausilia somchetica — Pfeiffer 1846: p. 94

Type locality. "Somchetia" (= Somkheti).

Distribution. Widely distributed along the ranges of the Greater and Lesser Caucasus. Isolated occurrences in the Oshten-Fisht mountain complex and at Stavropol (both in Russia), as well as in Kars Province (Turkey).

Habitat. Moist mountain forests and rocky subalpine meadows up to 2500 m; among leaf litter, in rock crevices and under stones.

Occurrence data. Samtskhe-Javakheti • N41.6976°, E43.5188°; 2420 m; leg. OD-IS, 2009 (IS, MS) • N41.7014°, E43.5131°; 2210 m; leg. JG-LM-MS, (ISU, MS) • N41.5260°, E43.0310°; 1320 m; leg. LM, 2020 (ISU) • N41.5187°, E43.0397°; 1510 m; leg. LM, 2020 (ISU) • N41.3995°, E43.6196°; 2050 m; leg. LM, 2017 (ISU).

Remarks. Somkheti, the type locality, is a loosely defined historic region roughly corresponding to the Kvemo Kartli Region and Lori Province in Armenia.

Elia (*Caucasica*) *tuschetica* (Likharev & Lezhava, 1961)

Figures 4G, 6B

Euxina (*Euxina*) *tuschetica* — Likharev and Lezhava 1961: p. 473, figs 1–3

Type locality. Kakheti Region, near the village Zemo Omalo, at 1900 m.

Distribution. Mountain Tusheti.

Habitat. Mountain forests and subalpine meadows between 1000 and 2000 m; among leaf litter, in rock crevices and under stones.

Occurrence data. Kakheti • N42.2765°, E45.3524°; 1280 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.2744°, E45.3517°; 1200 m; leg. DM, 2019 (HNHM 104477) • N42.2447°, E45.4987°; 1630 m; leg. DM, 2019 (HNHM 104481) • N42.2422°, E45.4946°; 1530 m; leg. DM, 2019 (HNHM 104480, MS) • N42.2170°, E45.4761°; 1220 m; leg. DM, 2019 (HNHM 104479, MS); LM, 2019 (ISU).

Elia (*Megaleuxina*) *derasa* (Mousson, 1863)

Figures 4H, 6C

Clausilia derasa — Mousson 1863: p. 400

Type localities. "Réduktaleh" (misspelled Redutkaleh, = Kulevi, Samegrelo-Zemo Svaneti Region) and Kutaisi (Imereti Region).

Distribution. Between the ranges of the Greater and Lesser Caucasus from the Black Sea coast to Tbilisi toward east.

Habitat. Cliffs in moist forests; in leaf litter and loose soil under cliff vegetation.

Occurrence data. Adjara • N41.7477°, E42.0996°; 1860 m; leg. LM, 2018 (ISU) • N41.7435°, E42.0823°; 1290 m; leg. LM, 2018 (ISU) • N41.7351°, E42.0930°; 1180 m; leg. LM, 2010 (ISU) • N41.6835°, E41.8889°; 550 m; leg. LM, 2014 (ISU). **Guria** • N41.8992°, E42.3707°; 1240 m; leg. LM, 2017 (ISU) • N41.8367°, E42.3314°; 2070 m; leg. LM, 2017 (ISU). **Imereti** • N42.3829°, E43.0122°; 950 m; leg. JG-LM, 2018 (ISU, JG) • N42.3778°, E42.6022°; 170 m; leg. LM, 2018 (ISU) • N42.3254°, E43.2678°; 630 m; leg. LM, 2021 (ISU) • N42.3095°, E42.6697°; 390 m; leg. JG, 2017 (JG) • N42.2998°, E42.9622°; 530 m; leg. AB-LM, 2021 (ISU) • N42.2945°, E42.7677°; 400 m; leg. JG, 2017 (JG); LM, 2021 (ISU) • N42.2890°, E43.2898°; 390 m; leg. LM-TM, 2021 (ISU) • N42.2873°, E43.2164°; 620 m; leg. LM, 2011 (ISU) • N42.2828°, E42.7583°; 210 m; leg. JG, 2017 (JG, MS) • N42.2771°, E42.7044°; 200 m; leg. JG, 2017 (JG, MS) • N42.2716°, E42.8531°; 350 m; leg. LM, 2016 (ISU) • N42.2620°, E42.9575°; 240 m; leg. LM, 2017 (ISU) • N42.2575°, E42.7102°; 150 m; leg. DM, 2018 (HNHM 104376) • N41.8695°, E42.7946°; 1690 m; leg. EC-JG-MO-MS, 2022 (JG, MS) • N41.8554°, E42.7910°; 1920 m; leg. EC-JG-MO-MS, 2022 (JG, MS). **Kakheti** • N41.8759°, E45.3564°; 1080 m; leg. LM, 2010 (ISU) • N41.8647°, 45.3355°; 1260 m; leg. LM, 2010 (ISU). **Racha-Lechkhumi and Kvemo Svaneti** • N42.5561°, E43.5721°; 1510 m; leg. JG-MS, 2021 (JG, MS) • N42.5561°, E43.5691°; 1560 m; leg. JG-MS, 2021 (JG, MS); JG-LM-MS, 2022 (ISU, JG, MS) • N42.5116°, E43.3983°; 1680 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.5069°, E43.4005°; 1650 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.4949°, E43.3523°; 1910 m; leg. LM, 2011 (ISU) • N42.4807°, E43.4404°; 1810 m; leg. JG-LM, 2018 (ISU, JG) • N42.4557°, E43.3847°; 2010 m; leg. AB-BJ-LM, 2021 (ISU) • N42.3914°, E42.9823°; 1520 m; leg. JG-MS, 2021 (JG, MS) • N42.3901°, E42.9737°; 1520 m; leg. JG-LM, (ISU, JG). **Samegrelo-Zemo Svaneti** • N43.1116°, E42.7441°; 1690 m; leg. LM, 2015 (ISU)

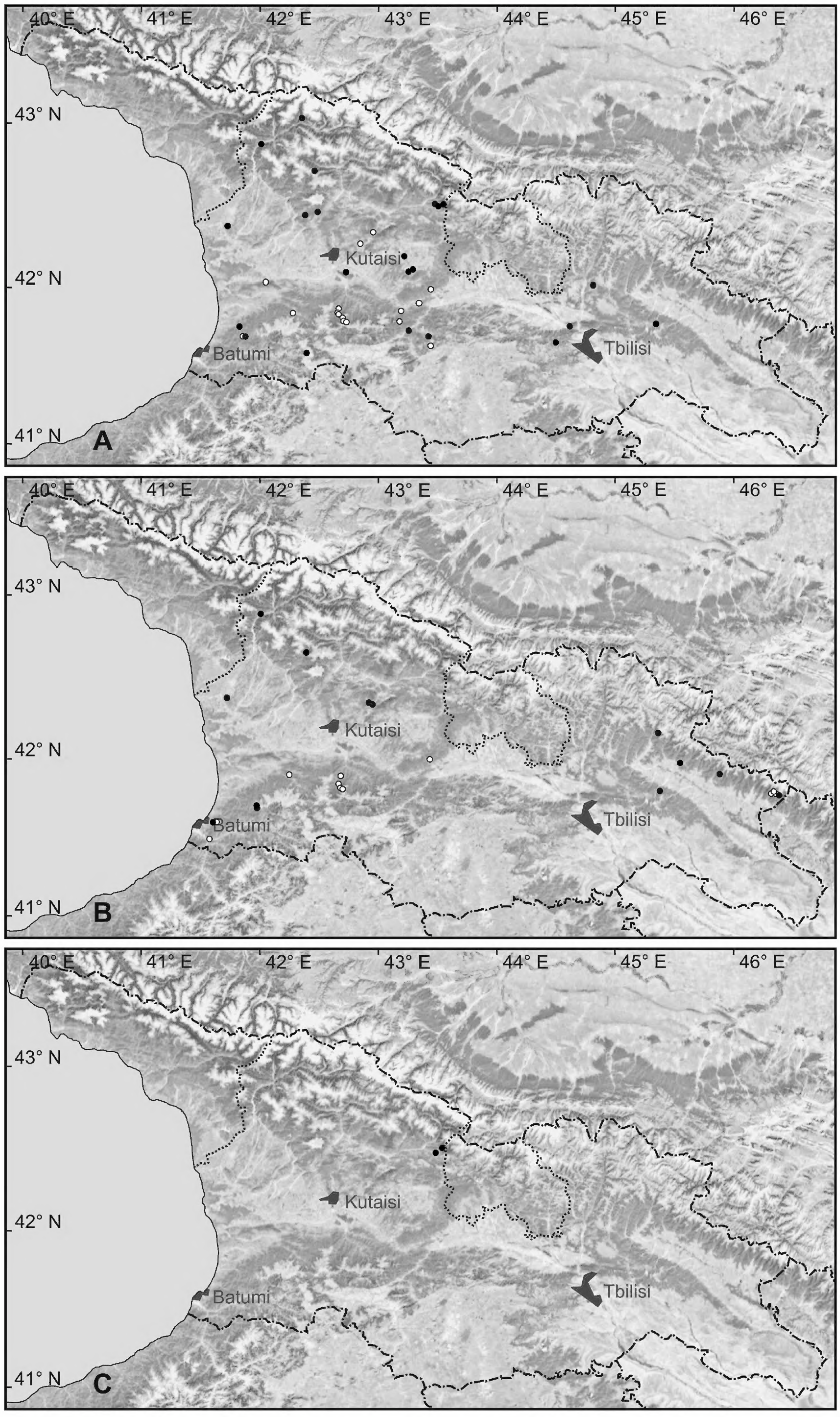

Figure 3. Occurrence records of *Pravispira semilamellata* (A), *Serrulina serrulata* (B) and *Acrotoma* (*Iliamneme*) *baryshnikovi* (C). Symbols are as in Figure 2.

Figure 4. (**A**) *Acrotoma* (*Iliamneme*) *baryshnikovi*, Racha-Lechkhumi and Kvemo Svaneti, Kvedi 1 Cave southeast of Kvedi, N42.5561°, E43.5721°. (**B**) *A.* (*I.*) *enguriensis*, Samegrelo-Zemo Svaneti, 6 km N of Jvari, N42.7500°, E42.0489°. (**C**) *Armenica* (*Armenica*) *unicristata*, Kakheti, Artsivi Gorge northwest of Dedoplistskaro, N41.4888°, E46.0956°. (**D**) *A.* (*Astrogena*) *griseofusca*, Turkey, Trabzon Province, Sümela south of Trabzon, N40.6894°, E39.6589°. (**E**) *Elia* (*Caucasica*) *ossetica*, Kakheti, Batsara Nature Reserve, N42.2229°, E45.3020°. (**F**) *E.* (*C.*) *somchetica*, Samtskhe-Javakheti, Didveli south of Bakuriani, N41.6976°, E43.5188°. (**G**) *E.* (*C.*) *tuschetica*, Kakheti, southwest of the Abano Pass, N42.2422°, E45.4946°. (**H**) *E.* (*Megaleuxina*) *derasa*, Samtskhe-Javakheti, east of the Goderdzi Pass, N41.6603°, E42.6042°. Scale bar: 5 mm.

• N43.0249°, E42.7682°; 2440 m; leg. LM, 2018 (ISU) • N42.7563°, E42.5114°; 2280 m; leg. LM, 2014 (ISU) • N42.7528°, E42.5093°; 2050 m; leg. LM, 2014 (ISU) • N42.7493°, E42.5071°; 1850 m; leg. LM, 2014 (ISU) • N42.7367°, E42.5015°; 1600 m; leg. LM, 2015 (ISU) • N42.6599°, E42.4330°; 950 m; leg. LM, 2010 (ISU) • N42.4772°, E42.4593°; 740 m; leg. LM, 2018 (ISU) • N42.3944°, E41.8382°; 450 m; leg. LM, 2010 (ISU); JG-MS, 2021 (JG, MS) • N42.3933°, E41.5617°; 10 m; leg. LM-TM, 2021 (ISU) • N42.3112°, E42.0660°; 100 m; leg. EC-JG-MO-MS, 2022 (JG, MS). **Samtskhe-Javakheti** • N41.8449°, E43.3748°; 920 m; leg. JG, 2017 (JG) • N41.8096°, E43.3121°; 2230 m; leg. LM, 2012 (ISU) • N41.7968°, E43.4599°; 1150 m; leg. LM, 2012 (ISU) • N41.7922°, E42.8394°; 1600 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.7863°, E43.2381°; 980 m; leg. LM, 2014 (ISU) • N41.7400°, E43.1572°; 1000 m; leg. LM, 2014 (ISU) • N41.7318°, E43.1361°; 1000 m; leg. LM, 2014 (ISU) • N41.6833°, E42.6537°; 1200 m; leg. LM, 2011 (ISU) • N41.6366°, E42.5797°; 1690 m; leg. LM, 2008 (ISU). **Shida Kartli** • N42.1339°, E43.6396°; 860 m; leg. LM, 2010 (ISU) • N42.0678°, E43.7848°; 670 m; leg. LM, 2014 (ISU) • N41.8130°, E44.2300°; 890 m; leg. LM, 2012 (ISU) • N41.7919°, E44.2567°; 1100 m; leg. LM, 2009 (ISU).

Euxinastra (*Euxinastra*) *hamata* (Boettger, 1888)

Figures 7A, 8A

Clausilia (*Euxinastra*) *hamata* — Boettger 1888: p. 152

Type locality. Batumi (Adjara Region).

Distribution. Mountainous areas along the Black Sea coast from Rize Province (Turkey) to the Adjara Region.

Habitat. Colchic deciduous forests; on decaying tree trunks and in leaf litter.

Occurrence data. Adjara • N41.7959°, E41.9452°; 210 m; leg. LM, 2018 (ISU) • N41.7351°, E42.0930°; 1180 m; leg. LM, 2010 (ISU) • N41.6617°, E41.8560°; 860 m; leg. LM, 2014 (ISU).

Filosa filosa (Mousson, 1863)

Figures 7B, 8B

Clausilia filosa — Mousson 1863: p. 395

Type locality. "Chysirkaleh" (unidentified locality somewhere southwest of Batumi, Adjara Region).

Distribution. Areas along the Black Sea coast from Trabzon Province (Turkey) to Adjara.

Habitat. Colchic deciduous forests; on decaying tree trunks and in leaf litter.

Occurrence data (Figure 8B): **Adjara** • N41.7959°, E41.9452°; 210 m; leg. LM, 2018 (ISU) • N41.7730°, E41.9692°; 280 m; leg. LM, 2008 (ISU) • N41.7627°, E41.9779°; 340 m; leg. LM, 2010 (ISU) • N41.7358°, E42.0410°; 1220 m; leg. LM, 2008 (ISU) • N41.7353°, E42.0196°; 720 m; leg. LM, 2008 (ISU) • N41.7020°, E41.7211°; 70 m; leg. JG, 2017 (JG) • N41.6984°, E41.7178°; 90 m; leg. LM, 2017 (ISU) • N41.6890°, E41.7055°; 40 m; leg. OD-IS, 2009 (IS, MS) • N41.6797°, E41.8880°; 450 m; leg. LM, 2014 (ISU) • N41.6769°, E41.8590°; 350 m; leg. LM, 2017 (ISU) • N41.6755°, E41.7069°; 40 m; leg. JG, 2017 (JG) • N41.6738°, E41.8543°; 450 m; leg. LM, 2014 (ISU) • N41.6713°, E41.6900°; 30 m; leg. JG, 2017 (JG) • N41.6699°, E41.8511°; 700 m; leg. LM, 2014 (ISU) • N41.6617°, E41.8560°; 860 m; leg. LM, 2014 (ISU) • N41.6527°, E41.7625°; 550 m; leg. LM, 2017 (ISU) • N41.5660°, E41.6136°; 60 m; leg. LM, 2008 (ISU) • N41.5652°, E41.5871°; 310 m; leg. LM, 2019 (ISU) • N41.5476°, E41.7564°; 80 m; leg. LM, 2017 (ISU) • N41.5150°, E41.7556°; 120 m; leg. LM, 2008 (ISU) • N41.4993°, E41.8398°; 420 m; leg. LM, 2017 (ISU).

Inobseratella lindholmi (Lindholm, 1912)

Figures 7C, 8C

Clausilia lindholmi — Lindholm 1912: p. 202

Type locality. "Berge Salolet" (= Mount Sallet south of Artvin, Turkey).

Distribution. The Parmak and Karçal Mountains in Artvin Province (Turkey) and the Meshkheti Range in the Guria Region.

Habitat. Deciduous forests above 800 m; on and around live trees.

Occurrence data. Guria • N41.8914°, E42.3697°; 1490, m; leg. EC-JG-LM-MO-MS, 2022 (ISU, JG, MS)

Remarks. The occurrence of *I. lindholmi* around the above mentioned site in the Guria Region has already been reported by Pokryszko et al. (2011). However, another record in the same publication from the Adjara Region (KIN3: N41.7730°, E41.9692°, 250 m) needs correction because, upon our examination, the specimen on which it had been based proved to be *Euxinastra hamata*.

Inobseratella monticola (Neubert, 1992)

Figure 7D

Kazancia monticola — Neubert 1992: p. 70, plate 1 fig. 4

Type locality. Çatköy south of Çamlıhemşin (Turkey, Rize Province).

Distribution. This species has been known to occur in the Fırtına Valley southwest of Çamlıhemşin (Turkey, Rize Province). Recently Mumladze et al. (2017) reported two specimens of this species from the valley of the Tsablarastskali Stream near Sairme (Imereti Region).

Habitat. Forested rocky areas; on trees, in vegetation beneath cliffs and under stones.

Mentissoidea rupicola (Mortillet, 1854)

Figures 7E, 9A

Clausilia rupicola — Mortillet 1854: p. 13, fig. 7

Type locality. Tortum (Erzurum Province, Turkey; likely erroneous!).

Distribution. Coastal areas of the Black Sea from Artvin Province (Turkey) to Gelendzhik (Russia), the Western Caucasus, southern slopes of the Greater Caucasus to Lagodekhi (Kakheti Region) and northern slopes of the Lesser Caucasus to the Murovdag (Azerbaijan) toward east. Isolated occurrences in Northern Ossetia and Chechnya.

Habitat. Broadleaf and mixed forests; on trees and under the bark of decaying logs.

Occurrence data. Adjara • N41.7477°, E42.0996°; 1860 m; leg. LM, 2018 (ISU) • N41.7351°, E42.0930°; 1180 m; leg. LM, 2010 (ISU). **Imereti** • N42.5023°, E42.5595°; 880 m; leg. JG-LM, 2018 (ISU, JG) • N42.3829°, E43.0122°; 950 m; leg. JG-LM, 2018 (ISU, JG) • N41.9236°, E42.7494°; 790 m; leg. JG-LM-MS, 2021 (ISU, JG, MS). **Kakheti** • N42.2765°, E45.3524°; 1280 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.1523°, 45.4171°; 580 m; leg. AB-BJ, 2019 (ISU) • N41.9823°, 45.8540°; 840 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.8647°, 45.3355°; 1260 m; leg. LM, 2010 (ISU) • N41.8556°, 46.3410°; 1730 m; leg. LM, 2010 (ISU) • N41.8490°, 46.3314°; 1300 m; leg. LM, 2010 (ISU). **Kvemo Kartli** • N41.7511°, 44.5094°; 1610 m; leg. LM, 2021 (ISU) • N41.6461°, E44.7057°; 1250 m; leg. LM, 2012 (ISU) • N41.3889°, E44.4419°; 880 m; leg. LM, 2013 (ISU). **Mtskheta-Mtianeti** • N42.3275°, E44.6368°; 1280 m; leg. DM, 2019 (HNHM 104470) • N42.3105°, E45.1229°; 1490 m; leg. LM, 2010 (ISU). **Racha-Lechkhumi and Kvemo Svaneti** • N42.5968°, E43.2395°; 770 m; leg. AB-BJ-LM, 2021 (ISU) • N42.5681°, E43.4953°; 1060 m; leg. LM, 2014 (ISU) • N42.5586°, E43.5741°; 1390 m; leg. EC-JG-LM-MO-MS, 2022 (MS) • N42.5561°, E43.5721°; 1510 m; leg. JG-MS, 2021 (JG, MS) • N42.5116°, E43.3983°; 1680 m; leg. EC-JG-LM-MO-MS, 2022 (MS) • N42.4807°, E43.4404°; 1810 m; leg. JG-LM, 2018 (ISU, JG) • N42.4557°, E43.3847°; 2010 m; leg. AB-BJ-LM, 2021 (ISU) • N42.3914°, E42.9823°; 1520 m; leg. JG-MS, 2021 (JG, MS) • N42.3876°, E42.9748°; 1500 m; leg. LM, 2018 (ISU). **Samegrelo-Zemo Svaneti** • N43.0311°, E42.7317°; 1850 m; leg. LM, 2018 (ISU) • N42.9109°, E42.0765°; 740 m; leg. LM, 2010 (ISU) • N42.7493°, E42.5071°; 1850 m; leg. LM, 2014 (ISU) • N42.7103°, E42.1522°; 640 m; leg. LM, 2010 (ISU) • N42.6599°, E42.4330°; 950 m; leg. LM, 2010 (ISU) • N42.4774°, E42.4587°; 700 m; leg. JG, 2019 (JG) • N42.3944°, E41.8382°; 450 m; leg. LM, 2010 (ISU); JG-MS, 2021 (JG, MS). **Samtskhe-Javakheti** • N41.7968°, E43.4599°; 1150 m; leg. LM, 2012 (ISU) • N41.7922°, E42.8394°; 1600 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.6833°, E42.6537°; 1200 m; leg. LM, 2011 (ISU) • N41.6366°, E42.5797°; 1690 m; leg. LM, 2008 (ISU).

Mucronaria (*Mucronaria*) *acuminata* (Mousson, 1876)

Figures 7F, 9B

Clausilia (*Mentissa*) *acuminata* — Mousson 1876b: p. 144, plate 5 fig. 4

Type locality. Vicinity of Lake Tabatskuri (Samtskhe-Javakheti Region).

Distribution. The Lesser Caucasus near Bakuriani (Samtskhe-Javakheti Region).

Habitat. Rocky subalpine meadows; among vegetation and under stones.

Occurrence data.

Samtskhe-Javakheti • N41.7014°, E43.5131°, 2210 m; leg. JG-LM-MS 2021 (ISU, JG, MS) • N41.6976°, E43.5188°, 2420 m; leg. OD-IS 2019 (IS, MS)

Mucronaria (*Mucronaria*) *duboisi* (Charpentier, 1852)

Figures 7G, 9C

Clausilia duboisi — Charpentier 1852: p. 402

Type locality. "Tauria" (= Crimea; erroneous!).

Distribution. Coastal areas of the Black Sea from Sinop (Turkey) to Sochi (Russia), the Western Caucasus, mainly the southern slopes of the Greater and mainly the northern slopes of the Lesser Caucasus. Isolated occurrence range in the Alborz Mountains in Mazandaran Province (Iran).

Habitat. Forests and rocky subalpine meadows; on trees, under loose bark and stones.

Occurrence data. Adjara • N41.4825°, E41.8629°; 540 m; leg. LM, 2017 (ISU). **Imereti** • N42.3821°, E43.0178°; 1000 m; leg. DM, 2018 (HNHM 104386) • N42.3254°, E43.2678°; 630 m; leg. LM, 2021 (ISU) • N42.2945°, E42.7677°; 400 m; leg. JG, 2017 (JG) • N42.2873°, E43.21640°; 620 m; leg. LM, 2011 (ISU) • N42.2836°, E43.2113°; 500 m; leg. JG-LM-MS, 2021 (ISU) • N42.2828°, E42.7583°; 210 m; leg. JG, 2017 (JG) • N42.2771°, E42.7044°; 200 m; leg. JG, 2017 (JG) • N42.2722°, E42.8530°; 380 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.2716°, E42.8531°; 350 m; leg. LM, 2016 (ISU) • N42.2620°, E42.9575°; 240 m; leg. JG, 2017 (JG) • N42.2443°, E43.2780°; 400 m; leg. AB-BJ-LM, 2021. N42.2357°, E43.3115°; 560 m; leg. EC-JG-LM-MO-MS, 2022 (MS) • N42.1476°, E42.8037°; 130 m; leg. LM, 2012 (ISU) • N42.0634°, E42.2694°; 70 m; leg. EC-JG-LM-MO-MS, 2022 (MS) • N42.0741°, E43.1626°; 260 m; leg. LM, 2014 (ISU) • N42.0558°, E43.1791°; 270 m; leg. LM, 2014 (ISU) • N42.0530°, E43.1676°; 350 m; leg. LM, 2014 (ISU) • N42.0522°, E43.1628°; 450 m; leg. LM, 2014 (ISU) • N42.0521°, E43.1822°; 320 m; leg. LM, 2014 (ISU) • N42.0290°, E42.8303°; 270 m; leg. DM, 2018 (HNHM 104382) • N41.9054°, E42.7442°; 910 m; leg. DM, 2018 (HNHM 104385) • N41.8832°, E42.7556°; 1270 m; leg. DM, 2018 (HNHM 104383) • N41.8695°, E42.7944°; 1680 m; leg. DM, 2018 (HNHM 104384); EC-JG-MO-MS, 2022 (JG, MS) • N41.8554°, E42.7910°; 1920 m; leg. EC-JG-MO-MS, 2022 (JG, MS). **Kakheti** • N42.2532°, E45.3321°; 890 m; leg. LM, 2019 (ISU) • N42.2368°, 45.3386°; 900 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.2229°, E45.3020°; 810 m; leg. DM, 2019 (HNHM 104476) • N42.1523°, E45.4171°; 580 m; leg. LM, 2019 (ISU) • N42.0765°, E45.8462°; 1400 m; leg. LM, 2010 (ISU) • N41.9837°, 45.8456°; 680 m; leg. LM, 2010 (ISU) • N41.9823°, 45.8540°; 840 m; leg.

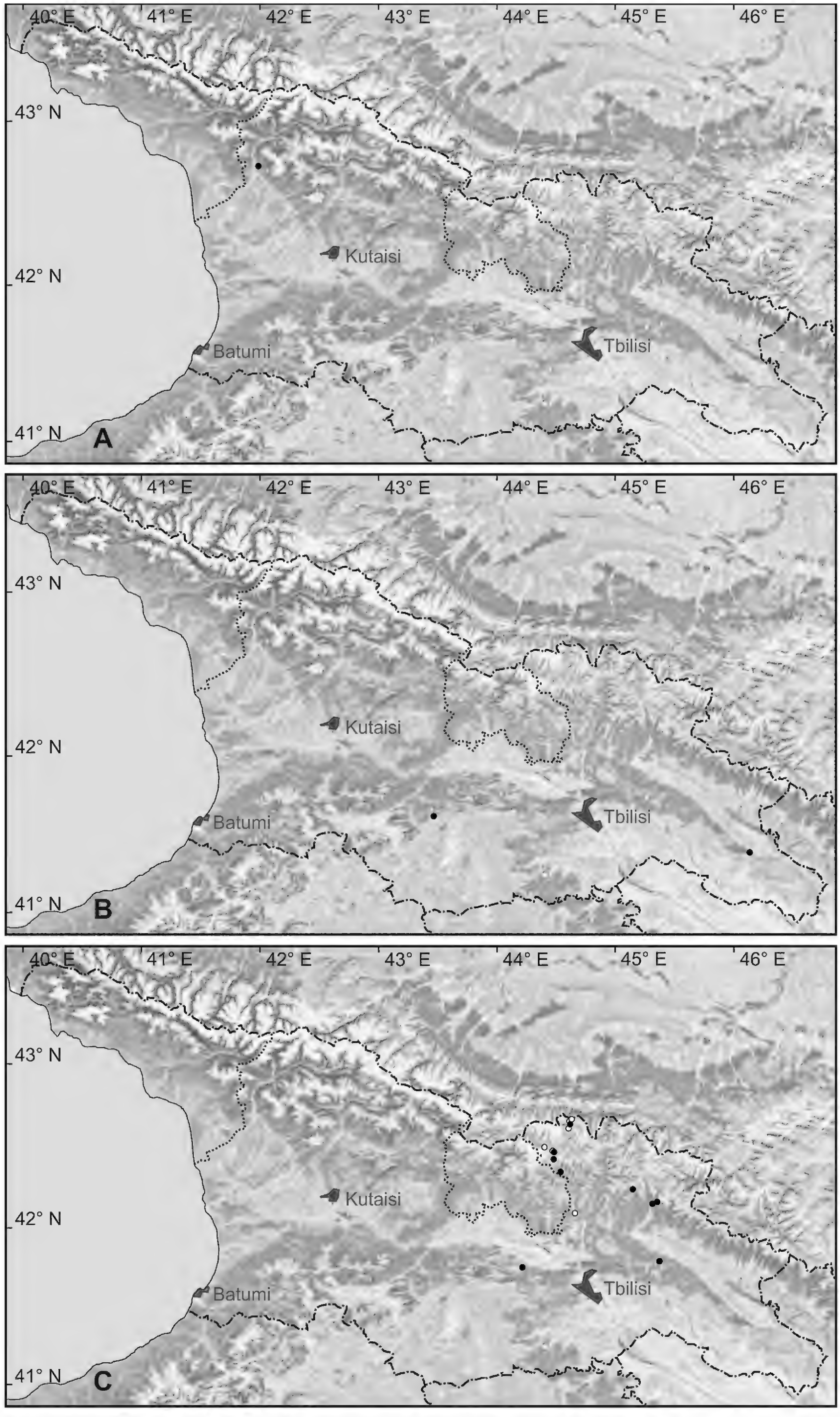

Figure 5. Occurrence records of *Acrotoma* (*Iliamneme*) *enguriensis* (A), *Armenica* (*Armenica*) *unicristata* (B) and *Elia* (*Caucasica*) *ossetica* (C). Symbols are as in Figure 2.

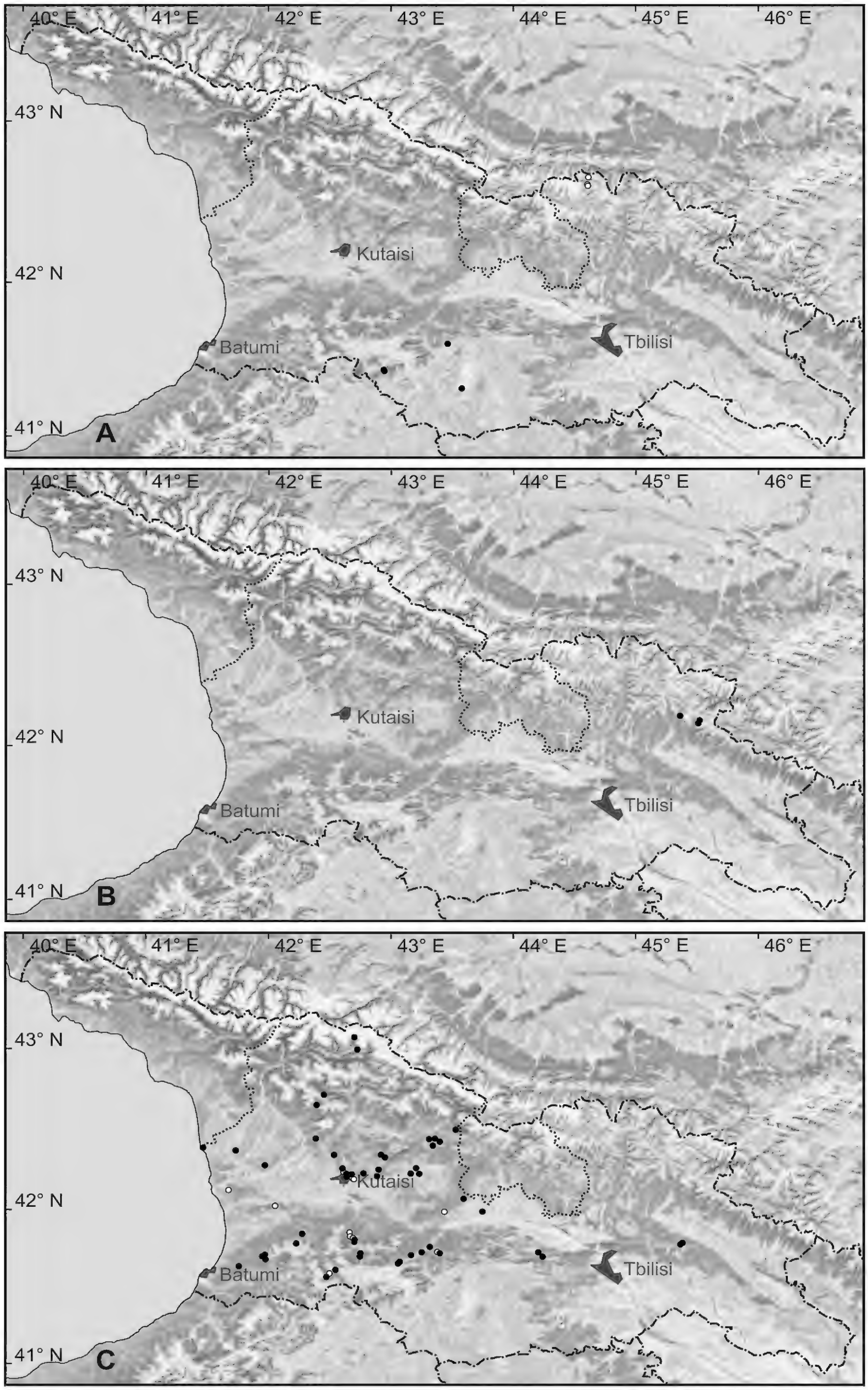

Figure 6. Occurrence records of *Elia* (*Caucasica*) *somchetica* (A), *Elia* (*C.*) *tuschetica* (B) and *Elia* (*Megaleuxina*) *derasa* (C). Symbols are as in Figure 2.

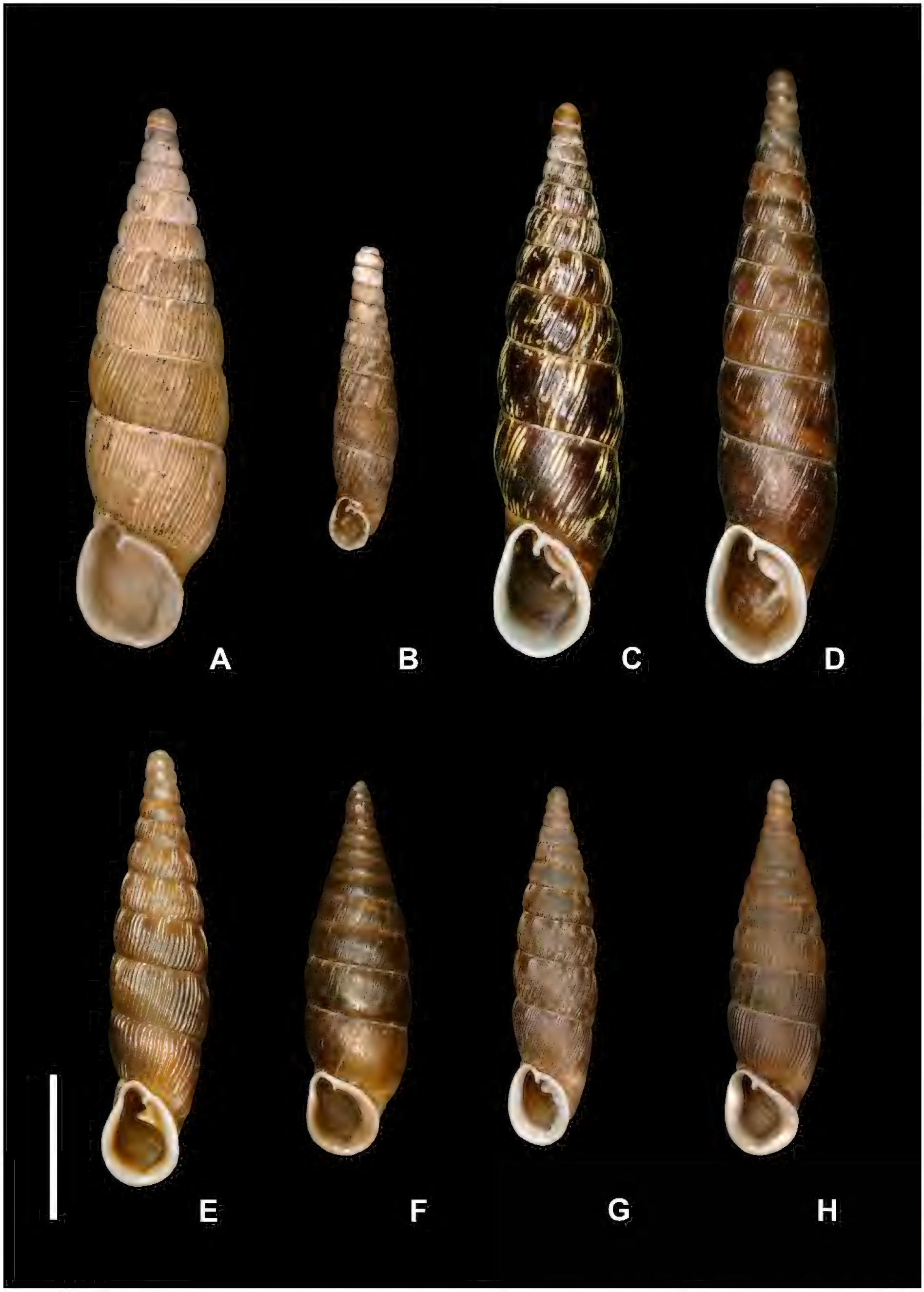

Figure 7. (**A**) *Euxinastra hamata*, Adjara, valley of the Tchorokhi River south of Mirveti, N41.5165°, E41.7170°. (**B**) *Filosa filosa*, Adjara, 2 km northeast of Korolistavi, N41.6502°, E41.7647°. (**C**) *Inobseratella lindholmi*, Guria, between Ckhakoura and Bakhmaro, N41.8914°, E42.3697°. (**D**) *I. monticola*, Turkey, Rize Province, Fırtına Valley S of Çamlıhemşin, N40.9600°, E40.9622°. (**E**) *Mentissoidea rupicola*, Samtskhe-Javakheti, south of Didveli, N41.7197°, E43.4949°. (**F**) *Mucronaria* (*Mucornaria*) *acuminata*, Samtskhe-Javakheti, north of the Tskhratskaro Pass, N41.7014°, E43.5131°. (**G**) *M.* (*M.*) *duboisi*, Imereti, near the Motsameta Monastery, N42.2828°, E42.7583°. (**H**) *M.* (*M.*) *strauchi*, Kvemo Kartli, NW of Sakavre, N41.8424°, E44.1628°. Scale bar: 5 mm..

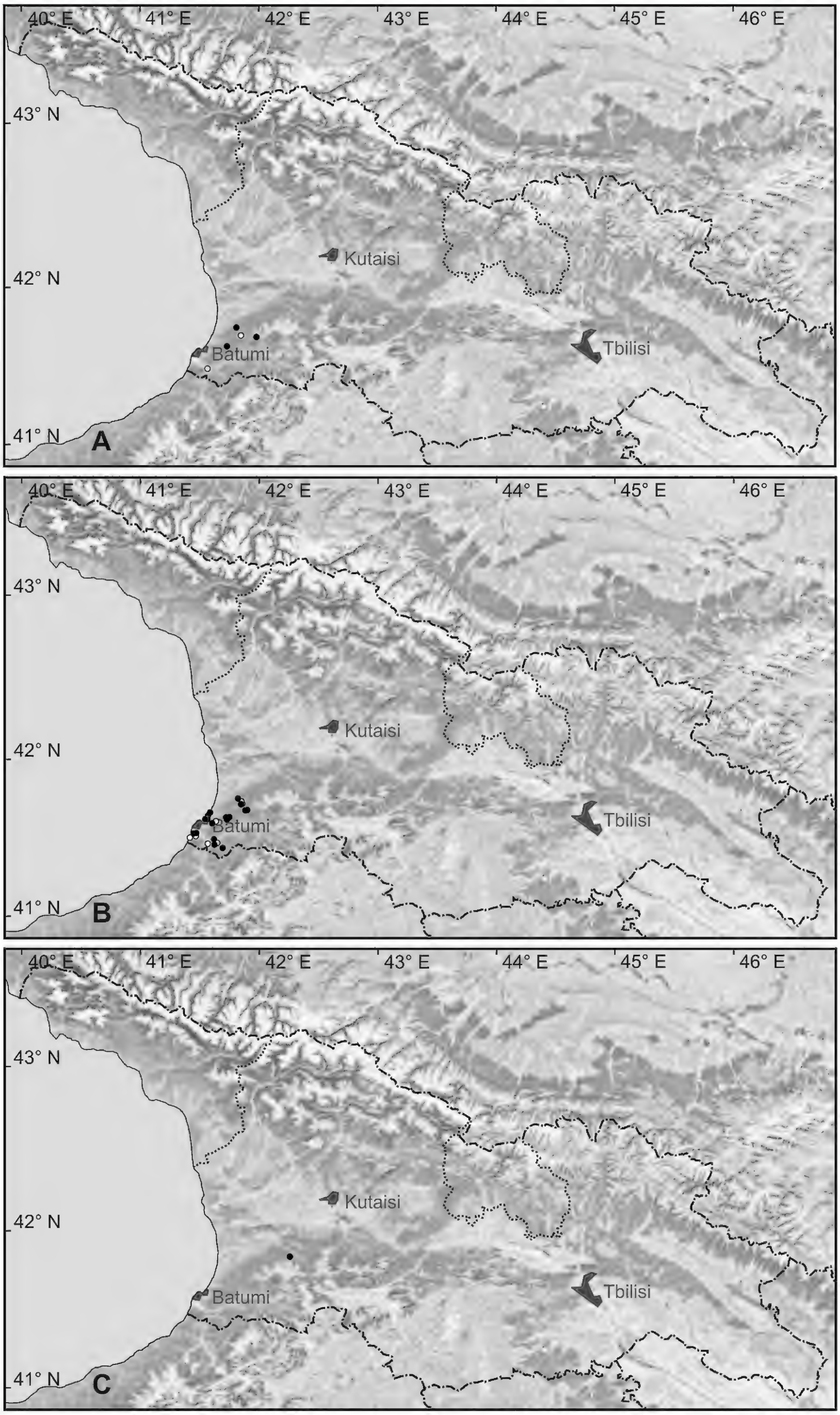

Figure 8. Occurrence records of *Euxinastra hamata* (A), *Filosa filosa* (B) and *Inobseratella lindholmi* (C). Symbols are as in Figure 2.

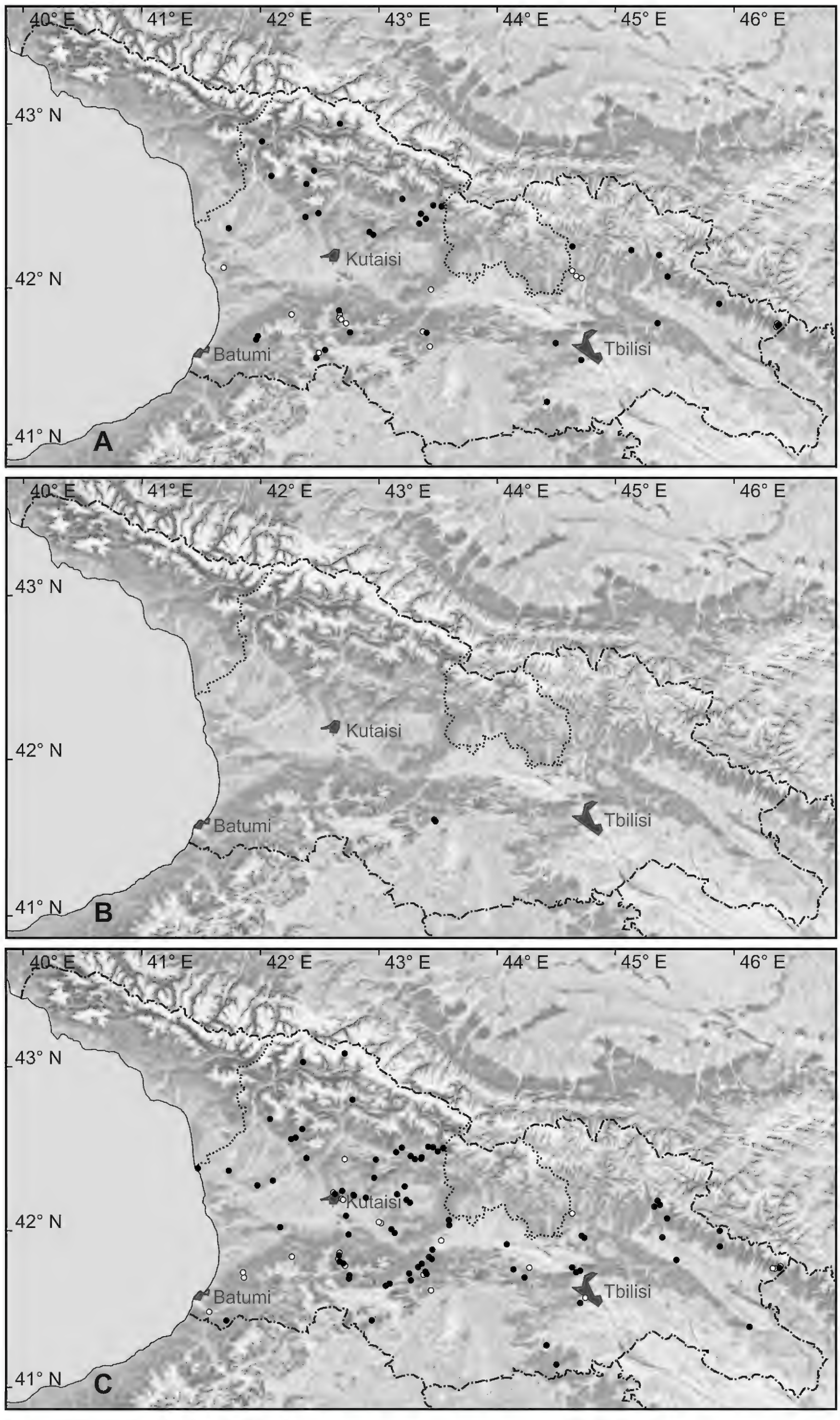

Figure 9. Occurrence records of *Mentissoidea rupicola* (A), *Mucronaria* (*Mucronaria*) *acuminata* (B) and *Mucronaria* (*M.*) *duboisi* (C). Symbols are as in Figure 2.

Figure 10. *Mucronaria* (*Mucronaria*) *kartvelica* sp. n., holotype (ISU TM-T003-H). Scale bar: 3 mm.

JG-LM-MS, 2021 (ISU, JG, MS) • N41.9016°, E45.4918°, 750 m; leg. LM, 2019 (ISU) • N41.8998°, E45.4874°; 780 m; leg. DM, 2019 (HNHM 104472) • N41.8556°, E46.3410°; 1730 m; leg. LM, 2010 (ISU) • N41.4935°, E46.10086°; 680 m; leg. LM, 2010 (ISU) • N42.03319°, E45.3774°; 440 m; leg. JG-LM-MS, 2021 (ISU, JG, MS). **Kvemo Kartli** • N41.6461°, E44.7057°; 1250 m; leg. LM, 2012 (ISU) • N41.3889°, E44.4419°; 880 m; leg. LM, 2013 (ISU) • N41.2675°, E44.5183°; 880 m; leg. LM, 2017 (ISU). **Mtskheta-Mtianeti** • N42.0424°, E44.7249°; 750 m; leg. LM, 2012 (ISU) • N42.0346°, E44.7458°; 640 m; leg. LM, 2012 (ISU) • N41.8625°, E44.6422°; 740 m; leg. LM, 2017 (ISU) • N41.8383°, E44.7160°; 520 m; leg. LM, 2017 (ISU) • N41.8290°, E44.6780°; 650 m; leg. LM, 2015 (ISU). **Racha-Lechkhumi and Kvemo Svaneti** • N43.0652°, E42.4118°; 1250 m; leg. LM, 2010 (ISU) • N42.8389°, E42.8211°; 980 m; leg DM, 2018 (HNHM 104380) • N42.5735°, E43.4569°; 850 m; leg. JG-LM, 2018 (ISU, JG) • N42.5681°, E43.4953°; 1060 m; leg. LM, 2014 (ISU) • N42.5596°, E43.2297°; 680 m; leg. AB-LM, 2021 (ISU) • N42.5586°, E43.5741°; 1390 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.5561°, E43.5721°; 1510 m; leg. JG-MS, 2021 (JG, MS) • N42.5561°, E43.5691°; 1560 m; leg. JG-MS 2021 (JG, MS), EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.5466°, E43.5308°; 1070 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.5340°, E43.1892°; 600 m; leg. JG-LM, 2018 (ISU, JG) • N42.5169°, E43.3116°; 1420 m; leg. LM, 2018 (ISU) • N42.5116°, E43.3983°; 1680 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.5083°, E43.3493°; 1850 m; leg. LM, 2010 (ISU) • N42.5004°, E43.3959°; 1780 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, MS) • N42.4985°, E43.3885°; 1780 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, MS) • N42.4949°, E43.3523°; 1910 m; leg. LM, 2011 (ISU) • N42.4837°, E43.0505°; 1050 m; leg. JG, (JG). **Samegrelo-Zemo Svaneti** • N43.1116°, E42.7441°; 1690 m; leg. LM, 2015 (ISU) • N42.7103°, E42.1522°; 640 m; leg. LM, 2010 (ISU) • N42.6599°, E42.4330°; 950 m; leg. LM, 2010 (ISU) • N42.6122°, E42.3827°; 470 m; leg. LM, 2014 (ISU) • N42.5969°, E42.3322°; 400 m; leg. LM, 2014 (ISU) • N42.4772°, E42.4593°; 740 m; leg. LM, 2018 (ISU) • N42.3944°, E41.8382°; 450 m; leg. LM, 2010 (ISU), JG-MS, 2021 (JG, MS) • N42.3933°, E41.5617°; 10 m; leg. LM-TM, 2021 (ISU) • N42.3585°, E42.1997°; 120 m; leg. LM, 2010 (ISU) • N42.3112°, E42.0660°; 100 m; leg. EC-JG-MO-MS, 2022 (JG, MS). **Samtskhe-Javakheti** • N41.9093°, E43.4839°; 790 m; leg. LM, 2014 (ISU) • N41.8957°, E43.5128°; 940 m; leg. LM, 2011 (ISU) • N41.8699°, E43.4185°; 790 m; leg. LM, 2011 (ISU) • N41.8680°, E43.4125°; 790 m; leg. LM, 2011 (ISU) • N41.8449°, E43.3748°; 920 m; leg. JG, 2017 (JG) • N41.8197°, E43.4470°; 10 m; leg. LM, 2012 (ISU) • N41.8096°, E43.3121°; 2230 m; leg. LM, 2012 (ISU)

Figure 11. The habitat (A) and a live individual (B) of *Mucronaria* (*Mucronaria*) *kartvelica* sp. n.

• N41.8092°, E43.3112°; 970 m; leg. LM, 2012 (ISU) • N41.8075°, E43.4696°; 1050 m; leg. LM, 2018 (ISU) • N41.7968°, E43.4599°; 1150 m; leg. LM, 2012 (ISU) • N41.7962°, E42.8445°; 1700 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.7675°, E43.3199°; 1230 m; leg. LM, 2011 (ISU) • N41.7649°, E43.3284°; 1370 m; leg. LM, 2020 (ISU) • N41.7400°, E43.1572°; 1000 m; leg. LM, 2014 (ISU) • N41.7318°, E43.1361°; 1000 m; leg. LM, 2014 (ISU) • N41.5187°, E43.0397°; 1510 m; leg. LM, 2020 (ISU). **Shida Kartli** • N42.1339°, E43.6396°; 860 m; leg. LM, 2010 (ISU) • N42.1048°, E43.6454°; 750 m; leg. LM, 2010 (ISU) • N41.9858°, E44.1096°; 610 m; leg. LM, 2020 (ISU) • N41.9463°, E43.5094°; 740 m; leg. LM, 2014 (ISU) • N41.8490°, E44.1731°; 1320 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.7919°, E44.2567°; 1100 m; leg. LM, 2010 (ISU).

Mucronaria (*Mucronaria*) *kartvelica* sp. n.

https://zoobank.org/0A0DEA45-B225-4BFD-AD89-3A26A6D0A025

Figures 10–12A

Differential diagnosis. The reduced, diffuse palatal plicae and the less elongate shell shape distinguish the new species from members of the subgenus *Mucronaria* (*Index*) Boettger, 1877 and position it in the subgenus *Mucronaria* (*Mucronaria*) Boettger, 1877. *Mucronaria* (*M.*) *kartvelica* sp. n. differs from all other species of its subgenus by the slender and strongly costate shell. By contrast, *Mucronaria* (*M.*) *acuminata* has ventricose shell with glossy, densely striate surface and very weak lamella superior, *Mucronaria* (*M.*) *duboisi* has strong, to the peristome margin extended lamella inferior and long, well outlined palatal plicae, whereas *Mucronaria* (*M.*) *strauchi* (Boettger, 1878) is less elongate, more

densely costate, and its ribs are more widely spaced on the neck than on the rest of the last whorl.

Type locality. Georgia, Racha-Lechkhumi and Kvemo Svaneti Region, at the Kvedi 1 Cave 2.2 km ESE of Kvedi village, N42.5561°, E43.5721°; 1510 m.

Type material. Type locality; 14.10.2021; leg. JG-MS, holotype (ISU TM-T003-H); paratypes (FMNH 392791/1, HNHM 105342/1, MNHN-IM-2014-7037/1, NHMUK 20220496/1, NHMW-MO-113737/1, SMF 368736/1, UF 580908/1, ZMH-MOL-0141473/1, JG/4, MS/3). Georgia, Racha-Lechkhumi and Kvemo Svaneti Region, at the Kvedi 2 Cave, 2 km ESE of Kvedi village, 42.5561°, E43.5691°; 1560 m; 14.10.2021; leg. JG-MS, paratypes (ISU TM-T003-P1/1, SMF 368737/1, JG/15, MS/9).

Further material. Georgia, Racha-Lechkhumi and Kvemo Svaneti Region, at the Kvedi 2 Cave 2 km ESE of Kvedi village, 42.5561°, E43.5691°; 1560 m; leg. EC-JG-LM-MO-MS 12.09.2022 (ISU, JG, MS).

Description. The brownish-corneous, slender spindle-shaped shell consists of 12.3 to 13.5 whorls. The apical part is elongate, its tip is pointed. The teleochonch whorls have strong and sharp ribs (25 to 28 on the last whorl), which become bulkier but not more widely spaced behind the aperture. The last whorl becomes narrower toward the base, which has a prominent basal crest. The relatively small aperture is oval to somewhat diamond-shaped, its wide peristome is slightly projected. The thin, weakly emerged lamella superior reaches the margin of the peristome. Inward it converges slightly toward the lamella inferior and terminates well before reaching the lamella spiralis, which starts ventrally and ends dorsally. The lamella inferior ends high and deep, its terminal part is only barely visible in apertural view of the shell. Ending even deeper, the lamella subcolumellaris cannot be viewed through the aperture. The plica principalis spans one third of the last whorl starting from the lateral side. The well discernable, dorsolaterally positioned upper plica runs close and parallel to it. Farther toward the base there are two or three lump-like reduced plicae, and a stronger and larger but also diffuse, callus-like basal plica. The broad clausilium plate widens before ending abruptly in a short, pointed tip. In some of the specimens its parietal margin is visible in oblique view through the aperture.

Dimensions (in mm): Shell height: 12.4–13.9 (holotype 12.9), spire width: 2.8–3.1 (holotype 2.9), aperture height: 2.4–2.6 (holotype 2.5), aperture width: 1.9–2.1 (holotype 2.0).

Anatomy. Unknown.

Habitat. Live individuals of *Mucronaria* (*M.*) *kartvelica* sp. n. were found on shaded limestone cliffs and among weeds (primarily *Hedera helix*) growing on those cliffs (Figure 11A–B), accompanied by *Acrotoma* (*Iliamneme*) *baryshnikovi*, *Elia* (*Megaleuxina*) *derasa*, *Mentissoidea rupicola* and *Mucronaria* (*M.*) *duboisi*.

Etymology. The name of the new species refers to its occurrence in Sa-kartvelo (native historic name for Georgia).

Remark. Whereas *Mucronaria* (*M.*) *duboisi* is one of the widest distributed clausiliids in the Caucasus region, reaching as far as Turkey's Sinop Province toward west and northern Iran toward east, all the other species of the subgenus *Mucronaria* (*Mucronaria*) are endemic to Georgia.

Mucronaria (*Mucronaria*) *strauchi* (Boettger, 1878)

Figures 7H, 12B

Clausilia strauchi — Boettger 1878b: p. 301, plate 10 fig. 6

Type locality. "Thianetauer Wald" (= Mtianeti, Mtskheta-Mtianeti Region).

Distribution. Endemic to central Georgia.

Habitat. Loosely forested areas; among rocks and weeds.

Occurrence data. Kvemo Kartli • N41.8125°, E44.9673°; 950 m; leg. MN, 1967 (ISU). **Mtskheta-Mtianeti** • N41.8624°, E44.6422°; 740 m; leg. LM, 2017 (ISU) • N41.8484°, E44.6379°; 480 m; leg. LM, 2014 (ISU) • N41.8383°, E44.7160°; 520 m; leg. LM, 2017 (ISU). **Shida Kartli** • N41.9463°, E43.5094°; 740 m; leg. LM, 2014 (ISU) • N41.8492°, E44.2949°; 1040 m; leg. LM, 2010 (ISU) • N41.8424°, E44.1628°; 1370 m; leg. JG-LM-MS, 2021 (MS). **Tbilisi** • N41.6841°, E44.7923°; 550 m; leg. LM, 2012 (ISU).

Mucronaria (*Index*) *index* (Mousson, 1863)

Figures 13A, 12C

Clausilia index — Mousson 1863: p. 401

Type localities. "Réduktaleh" (misspelled Redutkaleh, = Kulevi, Samegrelo-Zemo Svaneti Region) and "Chysirkaleh" (unidentified locality southwest of Batumi, Adjara Region).

Distribution. Coastal areas of the Black Sea between Batumi (Adjara) and Sukhumi (Abkhazia), inland to Borjomi (Samtskhe-Javakheti).

Habitat. Colchic forests; on or under loose bark of trees, among leaf litter and cliff vegetation.

Occurrence data. Adjara • N41.6890°, E41.7055°; 40 m; leg. OD-IS, 2009 (IS, MS) • N41.5663°, E41.5736°; 20 m; leg. LM, 2019 (ISU) • N41.5645°, E41.5703°; 10 m; leg. LM 2020 (ISU). **Guria** • N41.9081°, E42.1522°; 400 m; leg. LM, 2012 (ISU) • N41.9080°, E42.1529°; 380 m; leg. LM, 2012 (ISU). **Imereti** • N42.2828°, E42.7583°; 210 m; leg. JG, 2017 (JG, MS) • N42.2620°, E42.9575°; 240 m; leg. JG, 2017 (JG, MS) • N42.0587°, E42.2730°; 90 m; leg. LM 2014 (ISU) • N41.9236°, E42.7494°; 790 m; leg. JG-LM-MS, 2021 (MS). **Racha-Lechkhumi and Kvemo Svaneti** • N42.4807°, E43.4404°; 1810 m; leg. JG-LM, 2018 (ISU, JG). **Samegrelo-Zemo Svaneti** • N42.3944°, E41.8382°; 450 m; leg. JG-MS, 2021 (JG, MS) • N42.3112°, E42.0660°; 100 m; leg. EC-JG-MO-MS, 2022 (JG, MS) • N42.2113°, E41.7020°; 10 m; leg. LM, 2007 (ISU) • N42.1765°, E41.9452°; 10 m; leg. LM 2007 (ISU). **Samtskhe-Javakheti** • N41.7863°, E43.2381°; 980 m; leg. LM, 2007 (ISU).

Mucronaria (*Index*) *pleuroptychia* (Boettger, 1878)

Figures 13B, 14A

Clausilia pleuroptychia — Boettger 1878b: p. 291, plate 10 fig. 1

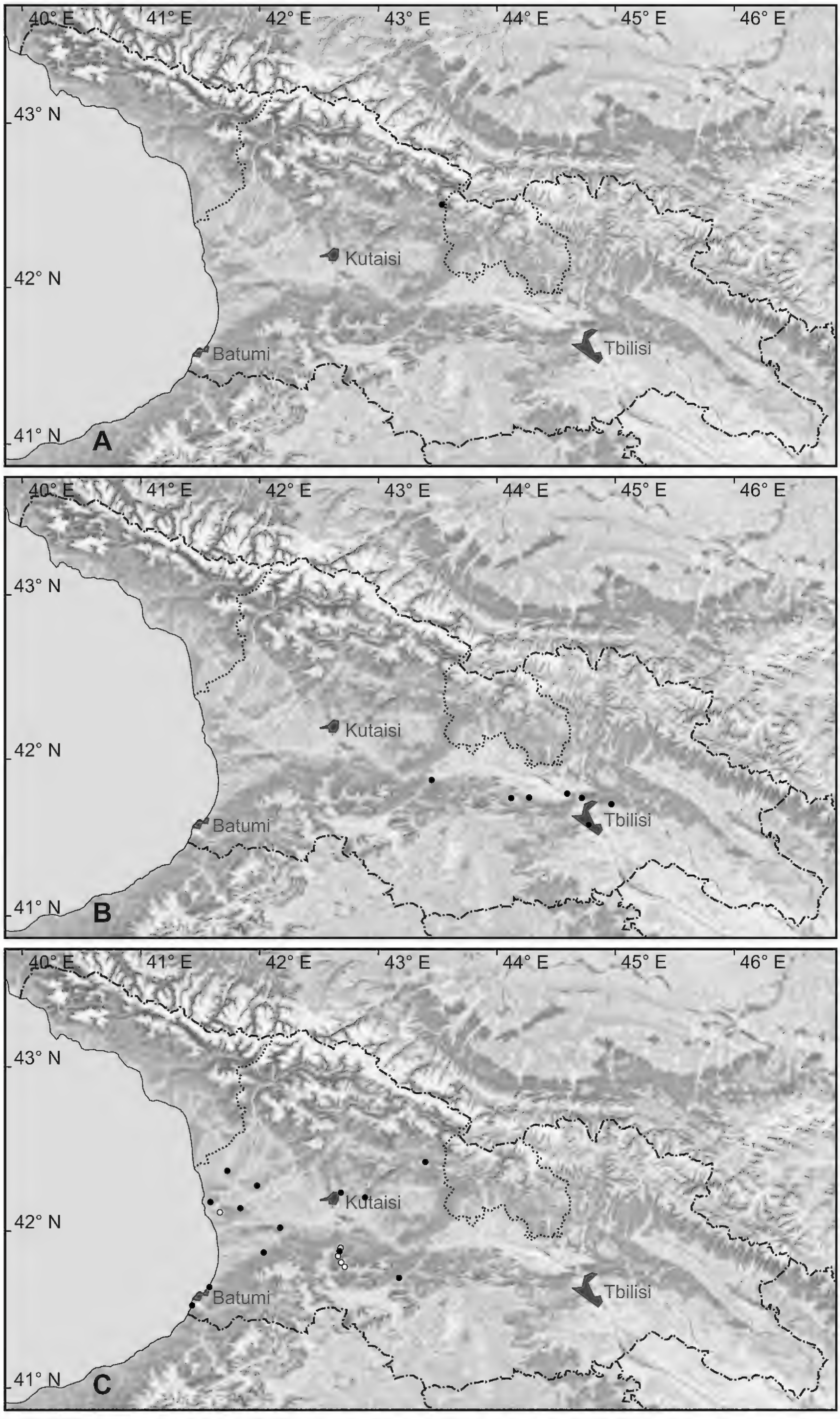

Figure 12. Occurrence records of *Mucronaria* (*Mucronaria*) *kartvelica* sp. n. (A), *Mucronaria* (*M.*) *strauchi* (B) and *Mucronaria* (*Index*) *index* (C). Symbols are as in Figure 2.

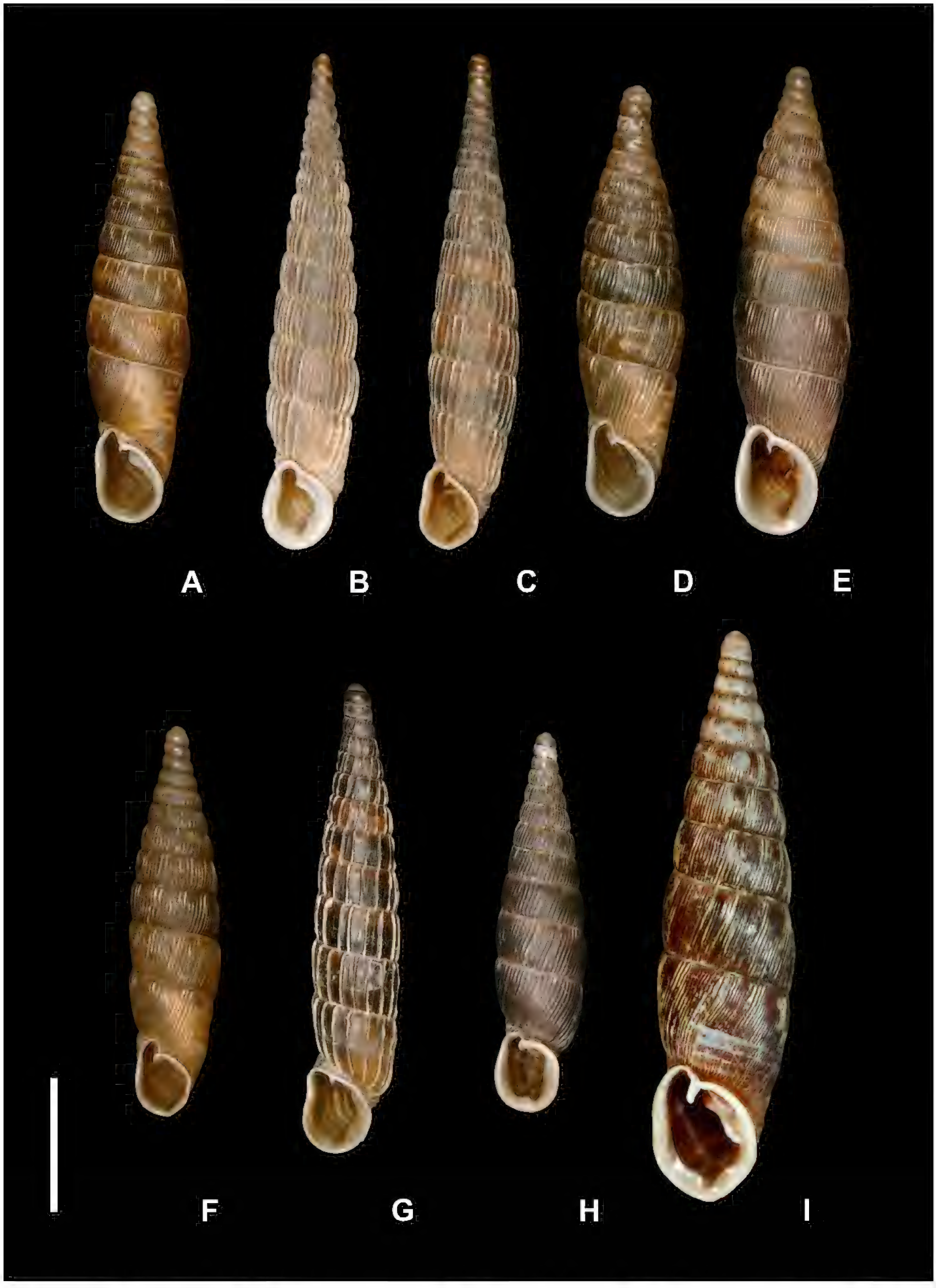

Figure 13. (**A**) *Mucronaria* (*Index*) *index*, Adjara, near Mtsvane Kontskhi, N41.6890°, E41.7055°. (**B**) *Mucronaria* (*Index*) *pleuroptychia*, Imereti, near the Motsameta Monastery, N42.2828°, E42.7583°. (**C**) *Quadriplicata dipolauchen*, Imereti, Satsiskvilo, N42.4792°, E42.5440°. (**D**) *Quadriplicata lederi*, Samtskhe-Javakheti, at the Mtsvane Monastery, N41.8036°, E43.3180°. (**E**) *Quadriplicata quadriplicata*, Kakheti, Artsivi Gorge northwest of Dedoplistskaro, N41.4921°, E46.0994°. (**F**) *Quadriplicata subaggesta*, Adjara, Makhinjauri northeast of Batumi, N41.6713°, E41.6900°. (**G**) *Quadriplicata* sp., Kakheti, Khadori Gorge, N42.2765°, E45.3524°. (**H**) *Scrobifera taurica*, Kakheti, valley of the Alazani River near Birkiani, N42.2368°, E45.3386°. (**I**) *Strigileuxina reuleauxi*, Imereti, north of Sairme, N41.9236°, E42.7494°. Scale bar: 5 mm

Type locality. "Syrien" (erroneous!).

Distribution. Southern Racha-Lechkhumi and northern Imereti Regions.

Habitat. Karst areas; in rock crevices and among roots of cliff vegetation.

Occurrence data. Imereti • N42.3838°, E43.0118°; 970 m; leg. JG-LM-MS, (ISU, MS) • N42.3821°, E43.0178°; 1000 m; leg. DM, 2018 (HNHM 104387) • N42.3254°, E43.2678°; 630 m; leg. LM, 2021 (ISU) • N42.2945°, E42.7677°; 400 m; leg. JG, 2017 (JG); LM, 2021 (ISU) • N42.2890°, E43.2898°; 390 m; leg. LM-TM, 2021 (ISU) • N42.2873°, E43.2164°; 620 m; leg. LM, 2011 (ISU) • N42.2836°, E43.2113°; 500 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.2833°, E43.2111°; 500 m; leg. LM, 2013 (ISU) • N42.2828°, E42.7583°; 210 m; leg. JG, 2017 (JG, MS) • N42.2719°, E42.7337°; 150 m; leg. LM, 2019 (ISU) • N42.2716°, E42.8531°; 350 m; leg. LM, 2016 (ISU) • N42.2712°, E42.8576°; 420 m; leg. JG, 2017 (JG) • N42.2620°, E42.9575°; 240 m; leg. JG, 2017 (JG, MS) • N42.2598°, E42.9583°; 990 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.2575°, E42.7102°; 150 m; leg. DM, 2018 (HNHM 104377). **Racha-Lechkhumi and Kvemo Svaneti** • N42.6679°, E42.7730°; 600 m; leg. MM, 2010 (ISU) • N42.5340°, E43.1892°; 600 m; leg. JG-LM, 2018 (ISU, JG-LM) • N42.5004°, E43.3959°; 1780 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, MS) • N42.4985°, E43.3885°; 1780 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, MS) • N42.4557°, E43.3847°; 2010 m; leg. AB-BJ-LM, 2021 (ISU) • N42.3901°, E42.9737°; 1520 m; leg. JG-LM, 2018 (ISU, JG) • N42.3876°, E42.9748°; 1500 m; leg. LM, 2018 (ISU).

Quadriplicata dipolauchen (Boettger, 1881)

Figures 13C, 14B

Clausilia (*Euxina*) *dipolauchen* — Boettger 1881a: p. 126

Type locality. Gordi (Imereti Region).

Distribution. Southeastern Samegrelo-Zemo Svaneti and northwestern Imereti Regions.

Habitat. Karst areas; in rock crevices and among roots of cliff vegetation.

Occurrence data. Imereti • N42.4792°, E42.5440°; 710 m; leg. JG, 2017 (JG, MS) • N42.4558°, E42.5291°; 640 m; leg. LM, 2021 (ISU) • N42.3750°, E42.5966°; 170 m; leg. JG-MS, 2021 (JG, MS) • N42.3295°, E42.6172°; 120 m; leg. LM, 2014 (ISU) • N42.3095°, E42.6697°; 390 m; leg. JG, 2017 (JG, MS). **Samegrelo-Zemo Svaneti** • N42.7514°, E42.0472°; 470 m; leg. JG-LM, 2018 (ISU, JG, MS) • N42.7410°, E42.0483°; 420 m; leg. JG-LM, 2018 (ISU, JG) • N42.7295°, E42.0923°; 680 m; leg. JG-MS, 2021 (JG, MS) • N42.6262°, E42.4014°; 520 m; leg. LM, 2014 (ISU) • N42.5969°, E42.3322°; 400 m; leg. LM, 2014 (ISU) • N42.4907°, E42.4231°; 340 m; leg. JG, 2017 (JG, MS) • N42.4791°, E42.3903°; 350 m; leg. JG-MS, 2021 (JG, MS) • N42.3832°, E42.2540°; 130 m; leg. LM, 2010 (ISU) • N42.3585°, E42.1997°; 120 m; leg. LM, 2010 (ISU).

Quadriplicata lederi (Boettger, 1878)

Figures 13D, 14C

Clausilia lederi — Boettger 1878a: p. 123

Type locality. Suram mountain ridge (Imereti and Shida Kartli Regions).

Distribution. Between the ranges of the Greater and Lesser Caucasus from the Black Sea to around Telavi toward east.

Habitat. Forests and rocky subalpine meadows; under leaf litter and bark, among stones and cliff vegetation.

Occurrence data. Adjara • N41.6458°, E42.4853°; 1630 m; leg. LM, 2017 (ISU) • N41.5663°, E41.5736°; 20 m; leg. LM, 2019 (ISU) • N41.5652°, E41.5871°; 310 m; leg. LM-TM, 2019 (ISU). **Guria** • N41.9081°, E42.1522°; 400 m; leg. LM, 2012 (ISU). **Imereti** • N42.4568°, E42.5991°; 310 m; leg. DM, 2018 (HNHM 104379) • N42.4560°, E42.5969°; 290 m; leg. DM, 2018 (HNHM 104378) • N42.4528°, E43.3903°; 1870 m; leg. EC-JG-LM-MO-MS, 2022 (MS) • N42.3838°, E43.0118°; 970 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, MS) • N42.3778°, E42.6022°; 170 m; leg. LM, 2018 (ISU) • N42.3095°, E42.6697°; 390 m; leg. JG, 2017 (JG, MS) • N42.2945°, E42.7690°; 410 m; leg. LM, 2021 (ISU) • N42.2771°, E42.7044°; 200 m; leg. JG, 2017 (JG, MS) • N42.2716°, E42.8531°; 350 m; leg. LM, 2016 (ISU) • N42.2443°, E43.2780°; 400 m; leg. AB-BJ-LM, 2021 (ISU) • N42.1476°, E42.8037°, 130 m; leg. LM, 2012 (ISU) • N42.0986°, E43.3846°; 440 m; leg. DM, 2018 (HNHM 104375) • N42.0741°, E43.1626°; 260 m; leg. LM, 2014 (ISU) • N42.0522°, E43.1628°; 450 m; leg. LM, 2014 (ISU) • N42.0521°, E43.1822°; 310 m; leg. LM, 2014 (ISU). **Kakheti** • N41.8759°, E45.3564°; 1080 m; leg. LM, 2010 (ISU) • N41.8647°, E45.3355°; 1260 m; leg. LM, 2010 (ISU). **Kvemo Kartli** • N41.6461°, E44.7057°; 1250 m; leg. LM, 2012 (ISU). **Racha-Lechkhumi and Kvemo Svaneti** • N42.8402°, E42.8802°; 1070 m; leg. DM, 2018 (HNHM 104381) • N42.5116°, E43.3983°; 1680 m; leg. EC-JG-LM-MO-MS, 2022 (JG, MS) • N42.5542°, E43.5083°; 900 m; leg. LM, 2014 (ISU) • N42.5083°, E43.3493°; 1850 m; leg. LM, 2010 (ISU) • N42.5069°, E43.4005°; 1650 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, JG, MS) • N42.5004°, E43.3959°; 1780 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, MS) • N42.4985°, E43.3885°; 1780 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, MS) • N42.4949°, E43.3523°; 1900 m; leg. LM, 2011 (ISU) • N42.4844°, E43.4295°; 1750 m; leg. LM, 2021 (ISU) • N42.3876°, E42.9748°; 1500 m; leg. LM, 2018 (ISU). **Samegrelo-Zemo Svaneti** • N42.7413°, E42.0485°; 430 m; leg. LM, 2015 (ISU) • N42.7367°, E42.5015°; 1600 m; leg. LM, 2015 (ISU) • N42.6599°, E42.4330°; 950 m; leg. LM, 2010 (ISU) • N42.6262°, E42.4014°; 520 m; leg. LM, 2014 (ISU) • N42.3944°, E41.8382°; 450 m; leg. JG-MS, 2021 (JG, MS). **Samtskhe-Javakheti** • N41.8957°, E43.5128°; 940 m; leg. LM, 2011 (ISU) • N41.8540°, E43.2392°; 1670 m; leg. LM, 2011 (ISU) • N41.8096°, E43.3121°; 2230 m; leg. LM, 2012 (ISU) • N41.8092°, E43.3112°; 970 m; leg. LM, 2012 (ISU) • N41.7968°, E43.4599°; 1150 m; leg. LM, 2012 (ISU) • N41.7962°, E42.8445°; 1700 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.7936°, E42.8520°; 1490 m; leg. LM,

2019 (ISU) • N41.7912°, E43.4665°; 1250 m; leg. LM, 2012 (ISU) • N41.7863°, E43.2381°; 980 m; leg. LM, 2014 (ISU) • N41.6651°, E42.8279°; 1080 m; leg. LM, 2017 (ISU). **Shida Kartli** • N42.1339°, E43.6396°; 860 m; leg. LM, 2010 (ISU).

Quadriplicata quadriplicata (Schmidt, 1868)

Figures 13E, 15A

Clausilia quadriplicata — Schmidt 1868: p. 163

Type locality. "Radtscha, Rudtscha oder Ructscha" (= Racha, Racha-Lechkhumi and Kvemo Svaneti Region).

Distribution. Southern slopes of the Greater Caucasus from Racha to the Caspian Sea, as well as the Lesser Caucasus east of Stepanavan (Armenia).

Habitat. Deciduous forests; on trees, in leaf litter and under stones.

Occurrence data. Kakheti • N42.2532°, E45.3321°; 890 m; leg. LM, 2019 (ISU) • N41.8611°, E46.3397°; 1830 m; leg. LM, 2013 (ISU) • N41.8572°, E46.3103°; 800 m; leg. LM, 2013 (ISU) • N41.8559°, E46.3115°; 830 m; leg. LM, 2013 (ISU) • N41.8556°, E46.3410°; 1730 m; leg. LM, 2010 (ISU) • N41.8537°, E46.3181°; 1020 m; leg. LM, 2013 (ISU) • N41.8490°, E46.3314°; 1300 m; leg. LM, 2010 (ISU) • N41.4935°, E46.1009°; 680 m; leg. LM, 2010 (ISU) • N41.4921°, E46.0994°; 710 m; leg, JG-LM-MS, (ISU, JG, MS) • N41.4896°, E46.0976°; 750 m; leg:, DM, (HNHM 104482, MS). **Mtskheta-Mtianeti** • N42.3105°, E45.1229°; 1490 m; leg. LM, 2010 (ISU).

Quadriplicata subaggesta (Retowski, 1887)

(Figures 13F, 15B)

Clausilia (*Euxina*) *subaggesta* — Retowski 1887: p. 37

Type locality. Black Sea coast between Sudak and Feodosia (Crimea; only marine flotsam!).

Distribution. Coastal areas of the Black Sea from Trabzon Province (Turkey) to Adjara. Inland to southernmost Imereti and northernmost Ardahan Province (Turkey).

Habitat. Broadleaf and mixed forests: on trees, under stones and among vegetation at shaded cliffs.

Occurrence data. Adjara • N41.8047°, E41.8843°; 90 m; leg. LM, 2018 (ISU) • N41.7959°, E41.9452°; 210 m; leg. LM, 2018 (ISU) • N41.7627°, E41.9779°; 340 m; leg. LM, 2010 (ISU) • N41.7433°, E42.0843°; 1250 m; leg. LM, 2018 (ISU) • N41.7377°, E41.9839°; 450 m; leg. LM, 2010 (ISU) • N41.7353°, E42.0196°; 720 m; leg. LM, 2008 (ISU) • N41.7351°, E42.0930°; 1180 m; leg. LM, 2010 (ISU) • N41.7269°, E42.0683°; 930 m; leg. LM, 2018 (ISU) • N41.7020°, E41.7211°; 70 m; leg. JG, 2017 (JG) • N41.6984°, E41.7178°; 90 m; leg. LM, 2017 (ISU) • N41.7074°, E41.7759°; 40 m; leg. LM, 2016 (ISU) • N41.6890°, E41.7055°; 40 m; leg. OD-IS, 2009 (IS, MS) • N41.6835°, E41.8889°; 550 m; leg. LM, 2014 (ISU) • N41.6806°, E41.8601°; 250 m; leg. LM, 2014 (ISU) • N41.6769°, E41.8590°; 340 m; leg. LM, 2017 (ISU) • N41.6755°, E41.7069°; 40 m; leg. LM, 2017 (ISU) • N41.6738°, E41.8543°; 450 m; leg. LM, 2014 (ISU) • N41.6713°, E41.6900°; 30 m; leg. JG, 2017 (JG) • N41.6617°, E41.8560°; 860 m; leg. LM, 2014 (ISU) • N41.6527°, E41.7625°; 550 m; leg. LM, 2017 (ISU) • N41.6315°, E42.4139°; 1120 m; leg. LM, 2017 (ISU). **Guria** • N41.9785°, E42.0714°; 130 m; leg. LM, 2018 (ISU) • N41.9081°, E42.1522°; 400 m; leg. LM, 2012 (ISU) • N41.8914°, E42.3697°; 1490 m; leg. EC-JG-LM-MO-MS, 2022 (MS). **Imereti** • N41.8837°, E42.7587°; 1420 m; leg. LM, 2013 (ISU).

Quadriplicata sp.

Figures 13G, 15C

Distribution. Upper valley of the Alazani River (Kakheti).

Habitat. Cliffs in deciduous forests above 1000 m; on cliffs and under stones.

Occurrence data. Kakheti • N42.2765°, E45.3524°; 1280 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.2744°, E45.3517°; 1200 m; leg. DM, 2019 (HNHM 104478).

Remark. This *Quadriplicata* represents a new species, which was discovered earlier by Bernhard Hausdorf's research team (Hamburg) at a location farther northwest in Kakheti. Its description is expected to be published soon by members of the Hamburg group.

Scrobifera taurica (Pfeiffer, 1848)

Figures 13H, 16A

Clausilia taurica — Pfeiffer 1848: p. 412

Type locality. "Tauria" (= Crimea; erroneous!).

Distribution. Southern slopes of the Greater Caucasus from the Black to the Caspian Sea, northeastern part of Artvin Province (Turkey) and northern slopes of the Lesser Caucasus to Mount Kapaz (Azerbaijan) toward southeast. Isolated occurrences in Northern Ossetia and near Pyatigorsk (Russia), as well as in the Zangezur Mountains (Armenia).

Habitat. Forests and mountain meadows up to the subalpine zone; on tree trunks, under the bark of decaying trees and among stones.

Occurrence data. Imereti • N42.5060°, E42.5581°, 880 m; leg. JG-MS, 2021 (JG, MS) • N42.5028°, E42.5579°; 860 m; leg. JG-MS, 2017 (JG) • N42.5023°, E42.5595°; 880 m; leg. JG-LM, 2018 (ISU, JG) • N42.3829°, E43.0122°; 950 m; leg. JG-LM, 2018 (ISU, JG) • N42.3778°, E42.6022°; 170 m; leg. LM, 2018 (ISU) • N42.3750°, E42.5966°; 170 m; leg. JG-MS, 2021 (JG, MS) • N42.2945°, E42.7690°; 410 m; leg. JG, 2017 (JG), LM, 2021 (ISU) • N42.2828°, E42.7583°; 210 m; leg. JG, 2017 (JG) • N42.2716°, E42.8531°; 350 m; leg. LM 2016 (ISU) • N42.1612°, E43.3577°; 830 m; leg. AB-BJ-LM, 2021 (ISU) • N42.1523°, E45.4171°; 580 m; leg. AB-BJ-LM, 2021 (ISU) • N42.0530°, E43.1676°; 350 m; leg. LM, 2014 (ISU) • N42.0529°, E43.1724°; 270 m; leg. LM, 2014 (ISU) • N42.0522°, E43.1628°; 450 m; leg. LM, 2014 (ISU) • N42.0521°, E43.1822°; 310 m; leg. LM 2014, (ISU) • N41.9236°, E42.7494°; 790 m; leg.

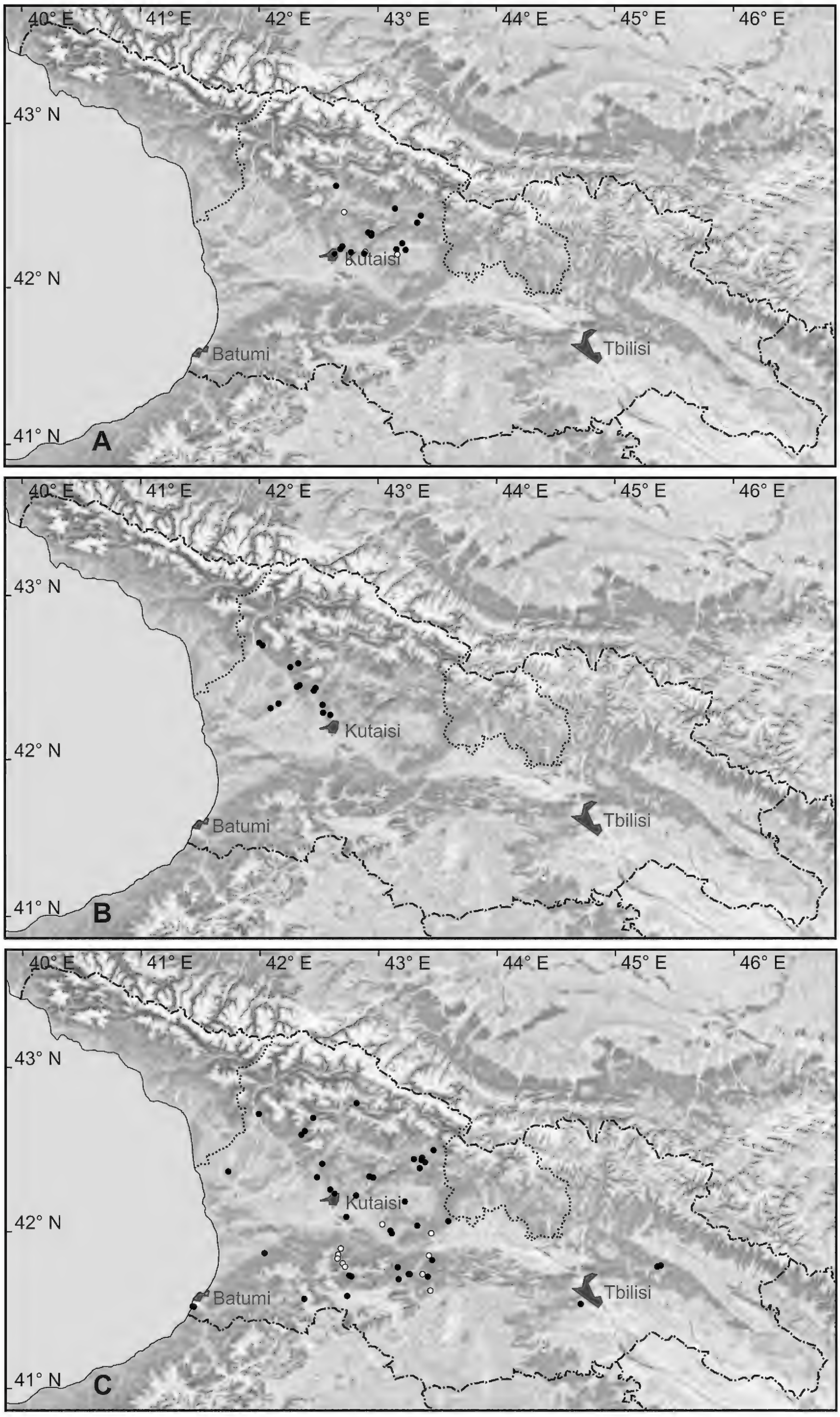

Figure 14. Occurrence records of *Mucronaria* (*Index*) *pleuroptychia* sp. n. (A), *Quadriplicata dipolauchen* (B) and *Quadriplicata lederi* (C). Symbols are as in Figure 2.

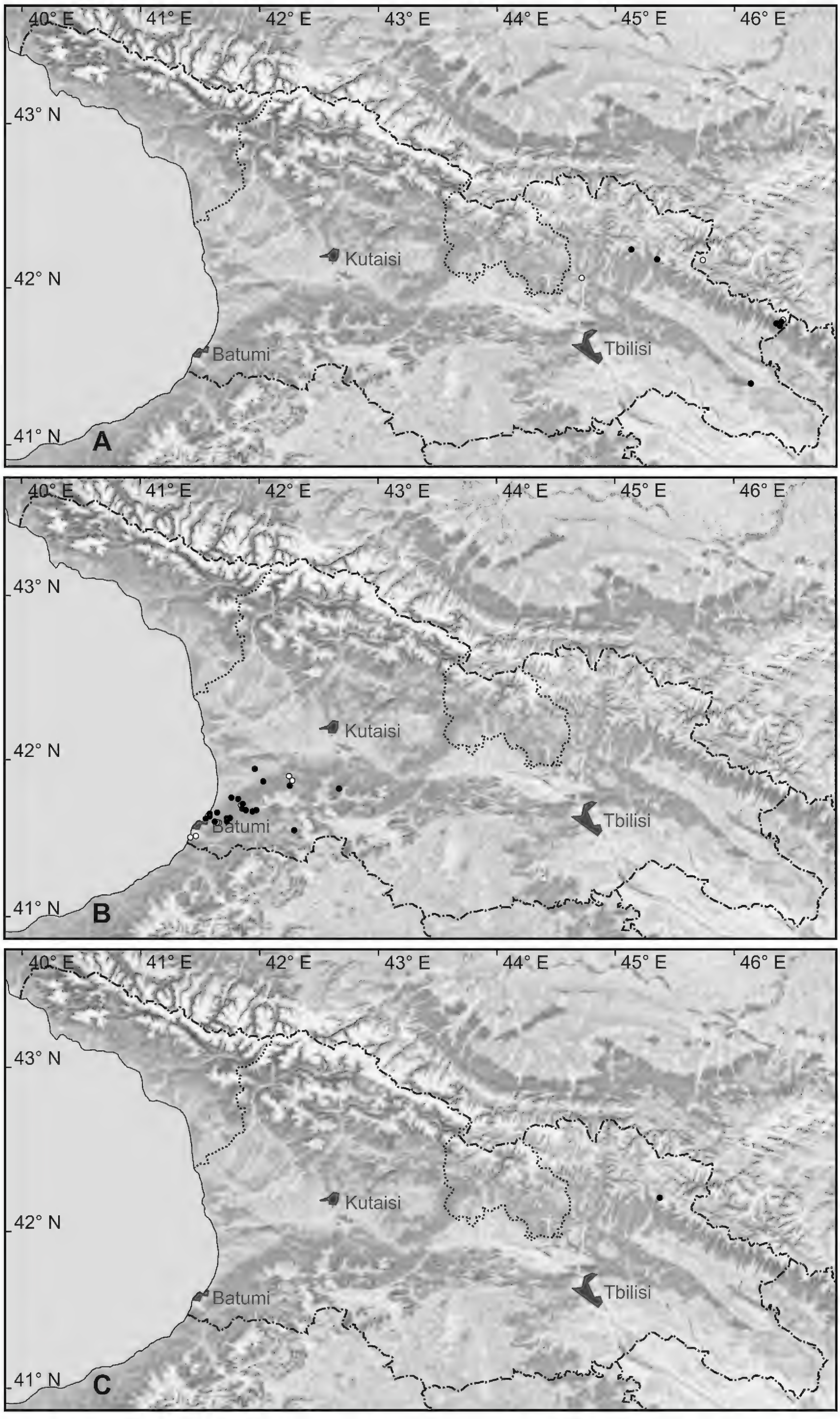

Figure 15. Occurrence records of *Quadriplicata quadriplicata* (A), *Quadriplicata subaggesta* (B) and *Quadriplicata* sp. (C). Symbols are as in Figure 2.

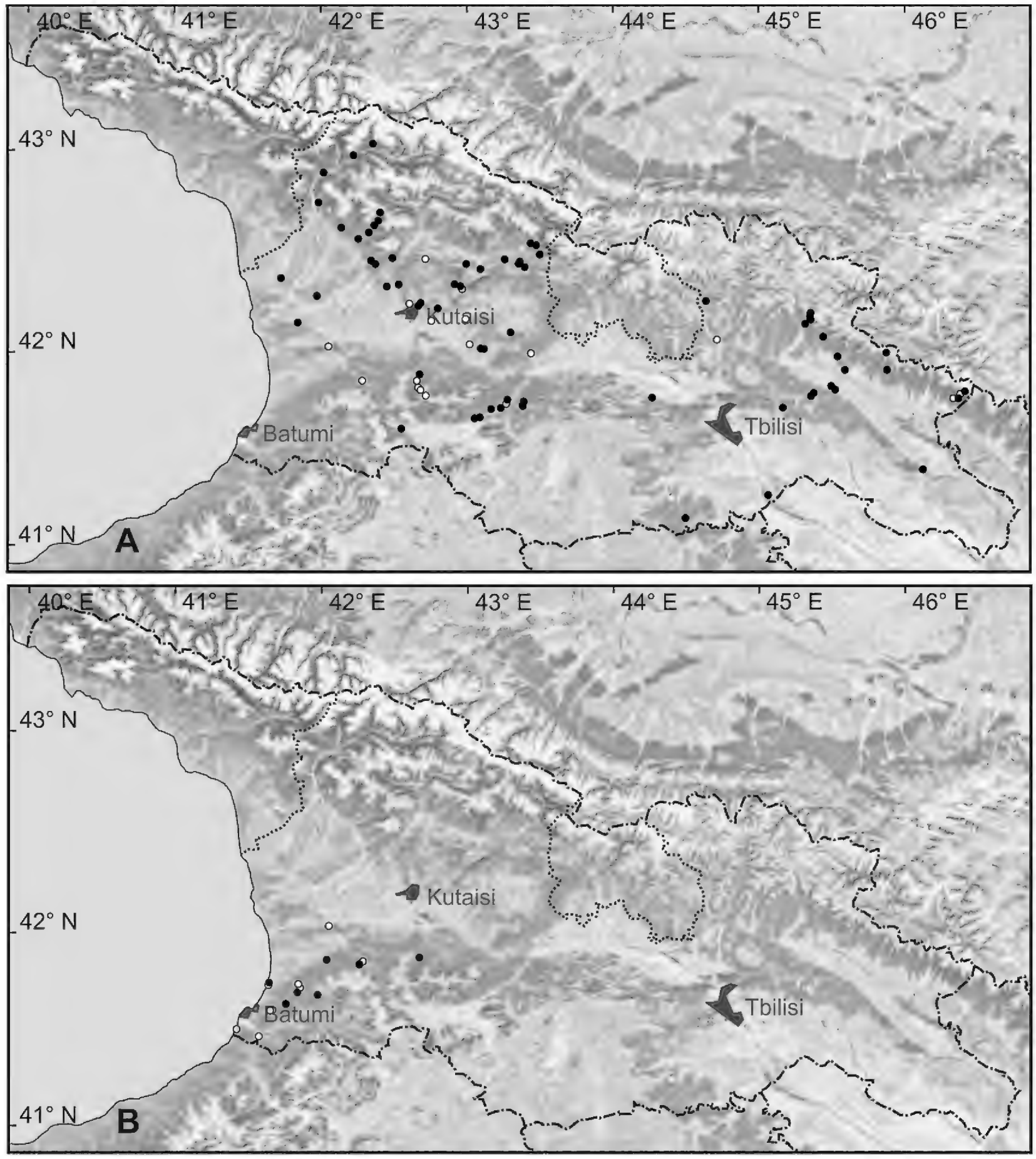

Figure 16. Occurrence records of *Scrobifera taurica* sp. n. (A) and *Strigileuxina reuleauxi* (B). Symbols are as in Figure 2.

JG-LM-MS, 2021 (ISU, JG, MS). **Kakheti** • N42.2765°, E45.3524°; 1280 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.2532°, E45.3321°; 890 m; leg. LM, 2019 (ISU) • N42.2368°, E45.3386°; 900 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N42.2229°, E45.3020°; 810 m; leg. DM, 2019 (HNHM 104474, MS) • N42.0765°, E45.8462°; 1400 m; leg. LM, 2010 (ISU) • N42.0539°, E45.5274°; 480 m; leg. LM, 2019 (ISU) • N41.9918°, E45.5779°; 350 m; leg. DM, 2019 (HNHM 104473) • N41.9837°, E45.8456°; 680 m; leg. LM, 2010 (ISU) • N41.9823°, E45.8540°; 840 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.9823°, E45.8540°; 840 m; leg. LM, 2010 (ISU) • N41.9761°, E45.8413°; 630 m; leg. JG-LM-MS, 2021 (ISU, JG, MS) • N41.9179°, E45.4898°; 660 m; leg. DM, 2019 (HNHM 104471) • N41.9016°, E45.4918°; 750 m; leg. LM, 2019 (ISU) • N41.8759°, E45.3564°; 1080 m; leg. LM, 2010 (ISU) • N41.8741°, E46.3788°; 2350 m; leg. LM, 2013 (ISU) • N41.8647°, E45.3355°; 1260 m; leg. LM, 2010 (ISU) • N41.8556°, E46.3410°; 1730 m; leg. LM, 2010 (ISU) • N41.8490°, E46.3314°; 1300 m; leg. LM, 2010 (ISU) • N41.8114°, E45.1527°; 900 m; leg. JG-LM-MS, 2021 (MS) • N41.4935°, E46.1009°; 680 m; leg. LM, 2010 (ISU) • N41.4921°, E46.0994°; 710 m; leg. JG-LM-MS, 2021 (ISU, JG, MS). **Kvemo Kartli** • N41.3745°, E45.0667°; 270 m; leg. LM, 2012 (ISU) • N41.2675°, E44.5183°; 880 m; leg. LM, 2017 (ISU). **Mtskheta-Mtianeti** • N42.3275°, E44.6368°; 1280 m; leg. DM, 2019 (HNHM 104469, MS). **Racha-Lechkhumi and Kvemo Svaneti** • N42.5735°, E43.4569°; 850 m; leg. JG-LM, 2018 (ISU, JG) • N42.5681°, E43.4953°; 1060 m; leg. LM, 2014 (ISU) • N42.5466°, E43.5308°; 1070 m; leg. EC-JG-LM-MO-MS, 2022 (ISU, MS) • N42.5169°, E43.3116°; 1430 m; leg. LM, 2018 (ISU) • N42.5116°, E43.3983°; 1680 m; leg. EC-JG-LM-MO-MS, 2022 (MS) • N42.4985°, E43.3885°; 1780 m; leg. EC-JG-LM-MO-MS, 2022 (MS) • N42.4844°, E43.4295°; 1750 m; leg. LM, 2018 (ISU), AB-GJ-LM, 2021 (ISU) • N42.4837°, E43.0505°; 1050 m; leg. JG, 2017 (JG, MS) • N42.4807°, E43.4404°; 1810 m; leg. JG-LM, 2018 (ISU, JG) • N42.4629°, E43.1380°; 860 m; leg. DM, 2018 (HNHM 104388) •

N42.3901°, E42.9737°; 1520 m; leg. JG-LM, 2018 (ISU, JG) • N42.3876°, E42.9748°; 1500 m; leg. LM, 2018 (ISU). **Samegrelo-Zemo Svaneti** • N43.0652°, E42.4118°; 1250 m; leg. LM, 2010 (ISU) • N43.0078°, E42.2917°; 830 m; leg. LM, 2015 (ISU) • N42.9109°, E42.0765°; 740 m; leg. LM, 2010 (ISU) • N42.7766°, E42.0540°; 720 m; leg. LM, 2015 (ISU) • N42.7367°, E42.5015°; 1600 m; leg. LM, 2015 (ISU) • N42.6988°, E42.4582°; 1050 m; leg. LM, 2014 (ISU) • N42.6599°, E42.4330°; 950 m; leg. LM, 2010 (ISU) • N42.6495°, E42.2051°; 320 m; leg. LM, 2018 (ISU) • N42.6262°, E42.4014°; 520 m; leg. LM, 2014 (ISU) • N42.6006°, E42.3466°; 450 m; leg. LM, 2015 (ISU) • N42.5969°, E42.3322°; 400 m; leg. LM, 2014 (ISU) • N42.4907°, E42.4231°; 340 m; leg. JG, 2017 (JG) • N42.4774°, E42.4587°; 700 m; leg. JG, 2019 (JG, MS) • N42.4772°, E42.4593°; 740 m; leg. LM, 2018 (ISU) • N42.3944°, E41.8382°; 450 m; leg. JG-MS, 2021 (JG, MS) • N42.3112°, E42.0660°; 100 m; leg. EC-JG-MO-MS, 2022 (MS) • N42.1765°, E41.9452°; 10 m; leg. LM, 2009 (ISU). **Samtskhe-Javakheti** • N41.8449°, E43.3748°; 920 m; leg. JG, 2017 (JG) • N41.8197°, E43.4470°; 1120 m; leg. LM, 2012 (ISU) • N41.8096°, E43.3121°; 950 m; leg. LM, 2012 (ISU) • N41.8092°, E43.3112°; 970 m; leg. LM, 2012 (ISU) • N41.7968°, E43.4599°; 1150 m; leg. LM, 2012 (ISU) • N41.7863°, E43.2381°; 980 m; leg. LM, 2014 (ISU) • N41.7400°, E43.1572°; 1000 m; leg. LM, 2014 (ISU) • N41.7318°, E43.1361°; 1000 m; leg. LM, 2014 (ISU) • N41.6833°, E42.6537°; 1200 m; leg. LM, 2011 (ISU). **Shida Kartli** • N41.8492°, E44.2949°; 1040 m; leg. LM, 2014 (ISU).

Strigileuxina reuleauxi (Boettger, 1887)

Figures 13I, 16B

Clausilia (*Euxina*) *reuleauxi* — Boettger 1887: p. 55

Type locality. Batumi (Adjara Region).

Distribution. Coastal areas of the Black Sea from Artvin Province (Turkey) to the Guria Region, inland to southwestern Imereti Region.

Habitat. Humid broadleaf forests; on trees and under the bark of decaying logs or among ground vegetation.

Occurrence data. Adjara • N41.7377°, E41.9839°; 450 m; leg. LM, 2010 (ISU) • N41.7351°, E42.0930°; 1180 m; leg. LM, 2010 (ISU) • N41.7020°, E41.7211°; 70 m; leg. JG, 2017 (JG, MS) • N41.6984°, E41.7178°; 90 m; leg. LM, 2017 (ISU) • N41.6797°, E41.8880°; 420 m; leg. LM, 2014 (ISU). **Guria** • N41.9080°, E42.1529°; 380 m; leg. LM, 2012 (ISU) • N41.8914°, E42.3697°; 1490 m; leg. EC-JG-LM-MO-MS, 2022 (JG, MS). **Imereti** • N41.9236°, E42.7494°; 790 m; leg. JG-LM-MS, 2021 (MS).

Discussion

Origin and establishment of the Georgian Clausiliidae fauna

The family Clausiliidae is one of the most diverse groups of terrestrial gastropods with around 1300 species occurring in large parts of Eurasia, Africa and tropical America (Nordsieck 2007). Of its seven extant subfamilies only two, the Phaedusinae and Clausiliinae occur in the Caucasus region (Uit de Weerd and Gittenberger 2013; Bouchet et al. 2017).

The Phaedusinae constitute an ancient clade that diverged from a common ancestor in southwestern Europe about 50 million years ago (mya). Among its genera occurring in Georgia *Pontophaedusa* Lindholm, 1924 represents the most basal lineage that is thought to have diverged around 30 mya in the Anatolian region (Uit de Weerd and Gittenberger 2013), from where all Caucasian Phaedusinae may have originated. Based on fossil records, the Caucasus region seems to have played an important role in the local diversification of the Phaedusinae (Likharev 1962; Steklov 1966). However, from the end of the Miocene period the gradually cooling and drying climate of western Eurasia caused a loss of diversity and territorial regression of this subfamily, the species of which usually require permanently humid and frost free habitats. The resulting modern Phaedusinae fauna of the Caucasus comprises relatively widespread species adapted to mountain forest habitats and also ones confined to narrow subterranean refugia along the temperate southeastern coast of the Black Sea.

Most of the clausiliids in the Caucasus region belong to the Clausiliinae subfamily. Compared to the Phaedusinae, this subfamily of western Eurasia is much more diverse and includes a number of species-rich genera. It has been shown that the subgeneric radiation of the Clausiliinae species is relatively recent, dating to the Pliocene or the second half of the Miocene period (Uit de Weerd and Gittenberger 2013; Hausdorf and Neiber 2022). The colonization of the Caucasus by the Clausiliinae could have begun soon after the emergence of the Lesser Caucasus as part of the Pontic-Anatolian mountain complex in the middle Miocene, around 15 mya (Popov 2004).

During the late Miocene and the Pliocene the Greater Caucasus played an important role in the diversification within the Clausiliinae genera. One of the best examples is that of *Acrotoma* Boettger, 1881, comprising 13 known species, which are all endemic to the western half of the Greater Caucasus (Hausdorf et al. 2018). In this genus the species level diversification could have resulted from the orogenic rearrangement of limestone areas, climate related habitat fragmentation and the colonization of novel, high mountain habitats (Koch et al. 2016; Hausdorf et al. 2018). The species of *Mucronaria* Boettger, 1877, *Micropontica* Boettger, 1881 and *Quadriplicata* Boettger, 1878 also diversified locally. The oldest fossil of *Quadriplicata* is known from the northwestern part of the Greater Caucasus and dates back to the transition between the Miocene and Pliocene periods (Steklov 1966). But in general, fossil records from the Caucasus region, and especially its Transcaucasian part, are scarce and require further exploration. Nevertheless, the available phylogenetic and paleontological data suggest that the radiation of the Caucasian Clausiliinae was driven primarily by climate transitions and the resulting habitat fragmentation, rather than by orogeny-related speciation scenarios (Hausdorf et al. 2018).

Species inventory

In the Caucasus region the clausiliids represent one of the best studied families of invertebrates. Despite the recent discovery of *Pontophaedusa gregoi* and *Mucronaria kartvelica* sp. n., the diversity, distribution and habitat preferences of the Georgian species are already well understood. Nevertheless, the geographic coverage of species inventories is still far from complete. For some of the clausiliids this information is still partial, leaving room for refining our knowledge on their distribution. For instance, the regions of Imereti and Kakheti are the best studied ones with 95 and 58 georeferenced sampling sites (comprising our data and published locations), representing 13 species in both regions. By contrast, in the cases of the Guria, Shida Kartli and Kvemo Kartli Regions the numbers of the sampling sites are only 12, 13 and 6, which correspond to 11, 6 and 6 species, respectively. Generally, the Pearson's correlation coefficient between the number of georeferenced sampling sites and species density among the regions is 0.82 (Table 1), indicating a potential for future increase in the resolution of species distributions.

The distribution areas of the common species *Scrobifera taurica* or *Mucronaria duboisi* are well documented, whereas those of some others (i.e., *Pontophaedusa gregoi* or *Inobseratella lindholmi*) are based merely on a few occurrence records. Such disparities reflect differences in the actual distribution and abundance of the species, but can also be exaggerated by unequal efficiencies of the sampling. For instance, collecting subterranean *Pontophaedusa gregoi* requires sampling from limestone crevices. Furthermore, its discontinuous, patchy habitat makes finding this species even harder. While perhaps it has a wider distribution area in the karst belt of western Georgia, discovering further localities could be difficult and may take some time. Another example is that of *Inobseratella lindholmi*, which occurs in virgin forests of beech (*Fagus orientalis*). The steep slopes of these mountain habitats and the dense undergrowth, dominated by *Rhododendron ponticum* and *Rubus caucasicus*, make their accessing rather difficult. For some species biased sampling may explain the absence of historical records and point out the limitations of further information gains. Even so, less studied regions and species should be subjected to further, more targeted research.

Distribution and habitat preferences

The occurrence data of the Georgian clausiliids reveal that the diversity of the species is highest in the western regions of the country and gradually decreases toward east (Table 2). Of the 30 known species of the study area 23 are forest-dwellers, and of these only *Caspiophaedusa perlucens* and *Quadriplicata quadriplicata* are restricted to the forests of central and eastern Georgia. The rest of the forest species are either endemic to western Georgia or have their centre of distribution along the eastern coast of the Black Sea. Among the seven petrophilic species six are obligate limestone-dwellers and only *Armenica unicrsitata* shows tolerance for other types of rocks. Of the cliff-dwelling species five occur exclusively in northwestern Georgia, whereas only *Quadriplicata* sp. is restricted to the eastern part of the country. Two narrow endemics, *Mucronaria acuminata* and *Ponrophaedusa gregoi*, are found only in subalpine or subterranean environments, respectively. By contrast, the widespread species *Mucronaria duboisi* and *Scrobifera taurica* occur almost over the entire territory of Georgia with high tolerance for different habitats, including anthropogenic ones. An assessment of the distribution and habitat types of the Georgian clausiliids is given in Table 2.

Of the 30 clausiliid species occurring in our study area 12 (40%) are endemic to Georgia. Only one of these, *Mucronaria acuminata*, is restricted to the Lesser Caucasus, whereas nine, *Acrotoma baryshnikovi*, *Acrotoma enguriensis*, *Mucronaria kartvelica* sp. n., *Mucronaria pleuroptychia*, *Mucronaria strauchi, Pontophaedusa gregoi, Quadriplicata dipolauchen, Elia tuschetic*a, and *Quadriplicata* sp., are confined to localities in the Greater Caucasus. Except for the last three these occur in the karst zone of western Georgia. Further two of the Georgian endemics, *Mucronaria index* and *Quadriplicata lederi*, are present in areas of both the Greater and Lesser Caucasus. Among the non-endemic species seven have their centres of distribution in the Pontic region, one in the Hyrcanian area, and further 10 are relatively widespread along the Caucasus ranges. In the uniquely local Clausiliidae fauna of Georgia 28 species are endemic to the Caucasus ecoregion and only the distribution areas of *Mucronaria duboisi* and *Serrulina serrulata* extend beyond its borders.

As shown in Figure 17, the clausiliids of Georgia show widely varied patterns of altitudinal distribution (see also: Mumladze et al. 2017). Eight species are present from sea level to the altitude of 2500 m, six are middle to high altitude species, and four are found only in high altitude habitats above 1200 m. The rest of the species inhabit regions of low or middle elevations, below 1700 m. Of the eight narrow endemic species two occur below 800 m, five at altitudes not higher than 2000 m, and only one above 2000 m (Table 2).

Species conservation and gaps in our knowledge

The Caucasus ecoregion has a relatively long and complex geological history (Popov 2004; Adamia et al. 2011) which, coupled with paleoenvironmental fluctuations, has resulted in a high diversity of landscapes, flora, and fauna. It is among the 36 global biodiversity hotspots, recognized as such because of their high species diversity, high rate of endemism and the vulnerability of their ecosystems as compared to similar-sized regions elsewhere (Myers et al. 2000; Zazanashvili et al. 2005; Noss et al. 2015). In this context terrestrial molluscs are one of the most exemplary groups of animals. In the Caucasus region they show exceptional diversity with over 300 species. Their remarkable average rate of endemism is 70%, but in certain groups it can be above 90% (Sysoev and Schileyko 2009). This is the case with the family of the Clausiliidae, in which this rate is 97% for the Caucasus ecoregion, involving 93% of the Georgian species. This clearly highlights conservation importance of this land snail group. Considering that most of the clausiliid species are habitat-specific, requiring forest or rock environments, they can be considered vulnerable. Notable exceptions are *Mucronaria duboisi*, *Scrobifera taurica* and, to a lesser extent,

Table 1. Summary statistics of samplings and species densities in the studied regions of Georgia.

Region	Territory (km²)	Sampling sites	km² per sample	Species density
Adjara	2800	50	58	12
Guria	2400	12	200	11
Imereti	6100	95	64	13
Kakheti	11300	58	198	13
Kvemo Kartli (including Tbilisi)	6600	6	1100	6
Mtskheta-Mtianeti	7000	23	304	9
Racha-Leckhumi and Kvemo Svaneti	5100	33	155	11
Samegrelo-Zemo Svaneti	7400	38	200	9
Samtskhe-Javakheti	6300	38	168	10
Shida Kartli	5600	13	438	6

Table 2. Distribution patterns and habitat types of the Georgian clausiliids.

Species	Biogeographic element	Distribution*	Habitat preference	Altitude range [m]	Georeferenced records	EOO | AOO [km²] **
Acrotoma baryshnikovi	Caucasian	GE	Limestone cliffs	1100–1600	3	10 | <15
Acrotoma enguriensis	Caucasian	GE	Limestone cliffs	400–500	2	<5 | <5
Armenica unicristata	Caucasian	RE	Cliffs	700–2300	3	–
Caspiophaedusa perlucens	Hyrcanian	ERE	Forest (decaying wood)	600–1800	15	–
Elia derasa	Caucasian	CRE	Forest (various microhabitats)	0–2500	80	–
Elia ossetica	Caucasian	CRE	Forest, rocky meadow	800–2500	16	–
Elia somchetica	Caucasian	RE	Forest, rocky meadow	1300–2500	8	–
Elia tuschetica	Caucasian	GE	Forest, rocky meadow	1200–1900	6	<2000 | <200
Euxinastra hamata	Pontic	WRE	Forest (various microhabitats)	0–1200	6	–
Filosa filosa	Pontic	WRE	Forest (various microhabitats)	0–1300	33	–
Inobseratella lindholmi	Pontic	WRE	Forest (tree trunks)	700–1500	2	–
Inobseratella monticola	Pontic	WRE	Forest (various microhabitats)	700–800	1	–
Mentissoidea rupicola	Caucasian	RE	Forest (various microhabitats)	0–2200	61	–
Mucronaria acuminata	Caucasian	GE	Subalpine rocky meadow	2200–2500	2	<5 | <5
Mucronaria duboisi	Caucaso-Anatolian	W	Forest, rocky meadow	0–2300	131	–
Mucronaria index	Caucasian	GE	Forest (various microhabitats)	0–2200	27	∞ | ∞
Mucronaria kartvelica sp. n.	Caucasian	GE	Limestone cliffs	1500–1600	2	<5 | <5
Mucronaria pleuroptychia	Caucasian	GE	Limestone cliffs	0–2100	27	2500 | <1000
Mucronaria strauchi	Caucasian	GE	Forest, rocky meadow	400–1400	8	∞ | <1000
Pontophaedusa funiculum	Pontic	WRE	Forest (decaying wood)	0–400	6	–
Pontophaedusa gregoi	Caucasian	GE	Subterranean	200–500	3	<100 | <15
Pravispira semilamellata	Caucasian	RE	Forest (decaying wood)	100–2300	48	–
Quadriplicata dipolauchen	Caucasian	GE	Limestone cliffs	100–800	14	<1500 | <1000
Quadriplicata lederi	Caucasian	GE	Forest, rocky meadow	0–2300	61	∞ | ∞
Quadriplicata quadriplicata	Caucasian	ERE	Forest (various microhabitats)	600–2300	18	∞ | ∞
Quadriplicata subaggesta	Pontic	WRE	Forest (various microhabitats)	0–1500	36	–
Quadriplicata sp.	Caucasian	GE	Limestone cliffs	1200–1300	2	<5 | <5
Scrobifera taurica	Caucasian	RE	Forest, rocky meadow	0–2400	124	–
Serrulina serrulata	Caucaso-Anatolian	W	Forest (decaying wood)	0–1900	29	–
Strigileuxina reuleauxi	Pontic	WRE	Forest (various microhabitats)	0–1500	18	–

* Species widespread (W), endemic to Georgia (GE), the Caucasus ecoregion (RE), or the western (WRE), central (CRE) or eastern (ERE) parts of the ecoregion; ** Estimations of the extent of occupancy (EOO) and area of occupancy (AOO) are explained in the Material and methods.

Quadriplicata subaggesta, which are frequently encountered in anthropogenic environments, such as gardens or concrete structures.

The conservation status has not been assessed for any of the Georgian (or Caucasian) clausiliids and, accordingly, none of these species is protected. Presently conservation is provided only by protected areas, which are supposed to shelter their habitats. However, a study by Mumladze et al. (2014) has shown that the current extent of protected areas in Georgia, corresponding to around 10% of the country's territory, can at best ensure the protection of 50% of the ranges where the endemic species occur.

The extent of occurrence (EOO) and area of occupancy (AOO) data of the endemic Georgian clausiliids are given in Table 2. These show that in the case of four of these species the AOO, the approximate size of the distribution area, is less than 20 km². Considering that the distribution ranges of the endemic clausiliids are relatively well documented, all these small range-restricted species might be assessed as endangered, whereas the others, except for *Mucronaria index* and *Quadriplicata lederi*, as vulnerable according to criteria of the IUCN (IUCN 2012).

For the protection of natural environments in Georgia the main concern is habitat alteration, which is an ever-increasing problem. One example is the vulnerability of the subterranean limestone crevices that provide habitat for *Pontophaedusa gregoi*. The entire distribution area of this species is within human settlements with unregulated heavy disturbances, such as grazing, logging, limestone mining and polluting. Due to their limited accessibility

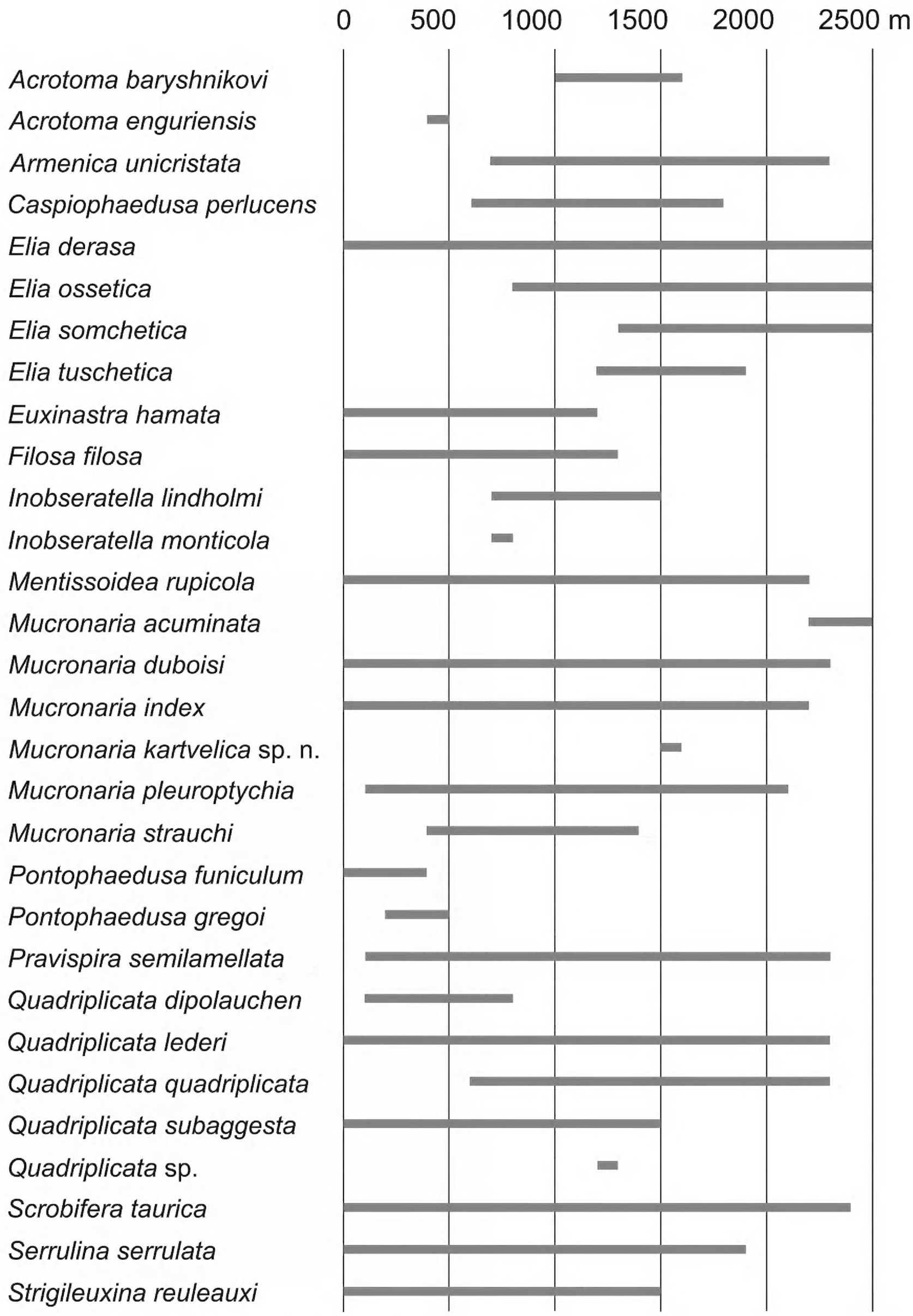

Figure 17. Elevational distribution ranges of the Georgian clausiliids.

the populations of this species are difficult to monitor, thus the only feasible way of protecting them could be the protection of their distribution ranges. Another good example is that of *Acrotoma enguriensis*, which also has a very narrow distribution range along the main road to Svaneti, a popular tourist area in the Caucasus. Its habitat is under increasing pressure from human disturbance (Grego and Mumladze 2019) and no measures have been taken so far to protect this species. Other range restricted clausiliids of Georgia have similarly grim prospects. Therefore, we propose measures ensuring their survival, primarily by means of habitat protection.

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